Electrical World

The consolidation of Electrical World and Engineer and American Electrician
Published by McGraw Publishing Company, Inc.

Vol. 61 NEW YORK, SATURDAY, FEBRUARY 1, 1913 No. 5

The Hunt for a "Money Trust"

Public utilities figured so largely in the "money-trust" statistics presented to the Pujo committee that it is comforting to have the assurance of one of Mr. Morgan's spokesmen that there really isn't any money trust at all. Opinions on this point will probably continue to differ, notwithstanding this assurance, but clearer notions of the concentration of capital will prevail if the statement made to the committee by Mr. H. P. Davison is duly considered. The popular method of constructing a money-trust specter is to make up a list of "interlocking directors," add together the capital of the companies on whose boards they are represented, and then to declare that $125,000,000,000, or some other mouth-filling amount, is under the exclusive control of a handful of men. The specter begins to look ridiculous when it is considered, as Mr. Davison pointed out, that the interlocking directors do not form a majority of the boards on which they sit, and that the capital they are supposed to control is not cash or its equivalent that may be juggled about at will, but is represented by investments in terminals, right-of-way, land, factories, machinery and other things not easily carried off in the directors' pockets. We did not need Mr. George F. Baker's admission that there is concentration of control of capital which in bad hands could be wrongfully used. This was already known. It has always existed everywhere. But if there is a "money trust" that need keep us awake nights, the Pujo committee, it is generally agreed, has failed to find it.

Cost of Gasoline and of Electricity

While in a sense the fuel cost for operating a gasoline or an electric vehicle is not burdensome, the continued increase in the price of the one as compared with the gradual decrease in the price of the other is becoming of international importance. So acute have conditions become in the gasoline automobile market that the consideration of cheaper distillates as fuel for internal-combustion engines is becoming imperative. Already a prize of $100,000 has been offered for a substitute for gasoline because that fuel is increasing in price at the rate of a cent a gallon a month. Here is a situation which should cause builders of electric vehicles to sit up and take note. By the general law of supply and demand the increasing use of gasoline must of necessity cause its price to soar still higher, whereas an increasing use of electricity has the opposite effect. No such law affects the sale of electricity, and it is certainly gratifying to note that whereas nearly all other commodities have increased in price during the past decade by leaps and bounds, the cost of electricity has been steadily decreasing, even in the face of the fact that translating devices have been improved to a very considerable extent, so that less electricity is needed to perform a given service. Increasing cost of fuel is not a theory but a condition now confronting the gasoline automobile industry, and the electric vehicle industry should make the most of the opportunity that this condition offers.

Aid for the Unfortunate

Attention is called to the simple and sensible terms of the plan inaugurated by the Union Electric Light & Power Company of St. Louis for loaning money to employees who might otherwise, to tide over an emergency, enter the snares of the loan shark. Every company executive has had personal experience with the need which exists for some means of alleviating temporary necessity in the case of deserving employees. And be it known, to the everlasting credit of such big-hearted administrators, the burden of furnishing the succor falls, more often than is ever suspected, on their own personal exchequers. The difficulty lies, however, in the reticence of the employee about consulting any one he has known concerning his troubles, and least of all his superior officer, who, he fears, might conceive a prejudice on this account. Instead, the borrower approaches the loan shark and enters into an iron-bound contract to pay to this social wolf an extortionate rate of interest which fastens him ever more securely in the money lender's clutches. The St. Louis plan contemplates allowing the employee to borrow, without interest, up to 50 per cent of his monthly salary, the amount to be repaid in at least 10 per cent instalments on the pay days following the loan.

Electrical Coal Mining

One of our important articles this week describes the large and successful use of electricity in the Cape Breton coal mines. As is well known to our readers, these mines in the vicinity of Glace Bay, Nova Scotia, have become of much importance, the field having a yearly output of 4,000,000 or 5,000,000 tons. The electrical installation in this territory began some half a dozen years ago with the installation of a 25-cycle alternating-current plant for one of the large collieries. The distribution in this case was over a comparatively moderate-sized territory at 6600 volts. The generators were engine-driven, and four years later in making a large addition to the plant a low-pressure turbine was put in place. The opening of new areas for mining has now shifted the center of the load and a second power house, as particularly described in the present article, has just been put into operation. This starts off as a 2000-kw proposition with the likelihood of considerable increase.

The most interesting feature of this new plant is the boiler equipment, in which finely pulverized coal is fed into the furnace with suitable air blast. Utilization of a low grade of coal is thus combined with the best possible combustion. The equipment is also very quick-steaming and can be pushed readily to meet the peak load. Energy for these plants is used for a wide variety of purposes, including pumping, conveying, operating fans, hoists and the like, besides the ordinary work of lighting. It is in hoisting, particularly, that electrical power shows best results, for no member of the steam-engine family is probably more hopelessly inefficient than the little hoisting engine. The electric motor doing the same work is, on the other hand, in itself a highly efficient machine and is fed with energy from a central-station plant operated under the best conditions of economy. And, for that matter, although less intermittent in operation, the use of pumps and fans driven by steam is almost equally bad, for the reciprocating pump in small sizes is notoriously a huge consumer of steam and few fans are large enough to permit the use of a really economical engine. Experience seems to have shown clearly that for the miscellaneous work of mining electric drive pays admirably, and there is no better evidence of this fact than the distributing system here described.

Electricity in Coast Defense

The annual report of General Weaver, chief of the Coast Artillery Corps, outlined in this issue, is admirable evidence of the importance of close attention to matters of electrical engineering in connection with the operation of our coast defense. Every coast fortification requires a considerable amount of electrical service for ordinary lighting and motive power, for search-lanterns and the work of submarine mining, besides the intricate equipment demanded by the systems necessary for communication and range-finding. Concerning the major uses of electricity, especially those which have to deal with lighting and motor operation, there is a strong tendency toward a change of policy. Until very recently the scheme most favored has been to provide each group of fortifications with a central steam-driven plant, reinforced by auxiliary oil or gasoline-engine plants for emergencies and local service. Although the installation of such central isolated plants was recommended by the National Coast Defense Board, the present tendency is toward securing the ordinary supply of electrical energy from commercial central-station circuits, reinforcing this service by local isolated oil-engine plants.

The change of policy here indicated is a wise one. The ordinary electrical supply of a group of fortifications for lamps and motors can be just as well derived from a large commercial station as from a special plant, and it can generally be thus obtained more cheaply. It is absolutely necessary, of course, that each fortification be independent as regards its emergency source of supply. In other words, a complete duplicate system of generation must be furnished because it would be the height of folly to take the chance of a stray shell leaving an important battery without light or motor service, if it chanced to plow through a connecting cable, or putting a whole group of batteries out of service by disabling the central station. The chance of crippling a commercial supply from a distance in time of war is certainly no greater than the chance of damage to a local system, since in the latter instance there is the element of danger to the plant itself in addition to the risk of interruption of the cable, which would exist in any case. Since it is at all events necessary to furnish each location with its own complete and independent supply, the ordinary source, for use in time of peace—and in time of war so long as it could hold out—can very properly be the central-station service of the locality.

One of the most important items in the coast-defense list is the search-lantern. General Weaver's report shows that it would take $2,500,000 to complete fully the search-lantern equipment necessary for coast defenses. These search-lanterns are to be provided as rapidly as possible, for it is obvious that they cannot be purchased on the open market in an emergency. The mirrors, in fact, are not made in this country at all.

Likewise in the submarine mine service the systems of cables, mines and all the intricate apparatus for their control have to be provided and kept ready for installation, since it, like the search-lantern equipment, cannot be picked up on short notice. The brief experience of the Spanish War showed this only too plainly, and the facilities for getting this highly expensive material are even now little, if any, better than they were before. To handle all this electrical equipment it is necessary to have highly efficient, trained men for the coast fortifications, and one of the most important educational steps taken in the service has been the establishment of a course of training in the Coast Artillery School at Fort Monroe. The electrical equipment for the general defenses, as shown by the report, is making good progress and well-trained men are available for the purpose of handling it.

Dielectrics in Alternating-Current Fields

It is coming to be recognized that in sending telegraph messages over long submarine cable lines by the usual electric signaling process with direct-current impulses governed by the dots and dashes of the Morse code, the dots having, say, plus polarity and the dashes minus, but all having equal duration, the conditions approximate those of low-frequency alternating-current operation. Whereas, however, in simple alternating-current operation the positive and negative impulses follow successively with unending regularity, in the operation of alphabet signaling any single positive impulse is as likely to be followed by a second positive impulse as by a negative impulse. However, the conditions may be regarded as embodying a righteous attempt to rise to the alternating-current sphere, with ever-apparent fallings away from grace. The devious imperfection of the alphabetical operation, regarded from the simple alternating-current standpoint, makes it necessary to apply alternating-current theory cautiously to practical signaling conditions and to treat the case as embodying a certain amount of deviation from the norm, the extent of such deviation being a matter for experimental determination.

The linear insulation resistance of submarine cables in good working order is very high. Its value is difficult to measure or to state with precision, since it depends upon the duration of the testing current and also, to some extent, upon the recent electrical history of the dielectric. If, for example, the linear insulation resistance of a submarine telegraph cable is measured, say, at the end of the second minute of direct-current application, it is likely to make a great difference whether the cable has been kept for a long time connected to ground at the sending end before applying the testing voltage or whether a testing voltage of opposite sign has been recently applied instead. These effects of time and of previous history are commonly included under the general influences of "electrification."

If the signaling process be regarded, however, as a rough approximation to alternating-current application, then evidently the proper method of measuring linear insulation resistance or its reciprocal, linear dielectric conductance, is with reference to alternating-current standards. It is found, in fact, that when an alternating emf of about the same frequency as that of reversal signaling—say, three or four cycles per second—is applied to the sending end of a very short cable, instead of a continuous emf, charging current enters the cable, and the component of this current in phase with the emf measures the power expended in the dielectric. Part of this power, ordinarily only a small part, is attributable to leakage conductance. The remainder is attributable to dielectric hysteresis. The leakage power develops Joulean heat in the dielectric. The hysteretic power develops hysteretic heat in the dielectric. Since the two thermal losses necessarily coalesce, they may be treated collectively as a simple leakage conductance. Whereas, however, a pure leakage conductance should be independent of the frequency, dielectric hysteretic power increases directly with the frequency, like magnetic hysteretic power. Consequently, an apparent leakage conductance due to hysteresis increases with the frequency. Expressed in another way, the power-factor of a very short submarine cable which has an alternating emf impressed on one end and is freed at the other end should be constant at all frequencies if the dielectric losses are hysteretic, but should diminish as the frequency increases if the dielectric losses are appreciably conductive or due to leakance.

At the very low frequencies of long submarine-cable signaling, the total alternating linear leakance, including hysteresis, is not of much importance, if the cable is in good working order. That is to say, the alternating-current leakance does not materially affect the working signaling speed. But at telephonic frequencies this leakance is likely to have a serious detrimental effect on the behavior of the cable.

In an article recently printed in the London *Electrician* Mr. G. L. Addenbrooke discusses some experimental observations of the apparent leakances of gutta-percha condensers at low frequencies. At any one temperature these leakances, when plotted as ordinates against frequency abscissas, follow approximately straight lines, in such a manner as to indicate a fairly constant conductive loss plus a fairly large hysteretic term. It is possible that in time insulation measurements of submarine cables, either short or long, may come to be made with low-frequency pure alternating emf. Simple formulas are already available for separating the influence of the copper losses from the dielectric losses over any or all lengths of cable.

The Grounded Neutral

A well-considered paper on the grounded neutral by Mr. J. S. Peck is referred to in the *Digest* in this issue. The author's discussion has largely to do with the matter of grounding in the case of high-voltage transmission circuits. In case of secondary distribution there seems to be only one answer to the grounding question, and that in favor of the practice. The mere question of danger to life in a low-tension distributing system of the character now generally employed is sufficient to settle this question once for all, any incidental objections dropping out of sight. In high-tension work, however, there are other matters to be considered.

Grounding materially increases the factor of safety in the insulation, and this result is extremely desirable. We do not think that the cheapening of insulation due to grounding is an important matter since the advantage is better applied to raising the factor of safety. The greater ease of protection against lightning due to the cause just mentioned is an additional advantage to be gained, since lightning is one of the few contingencies on transmission lines which cannot be easily guarded against. When an equipment is once arranged for grounded operation, there seems to be no adequate reason for eliminating the ground connection, and hence the objection which may possibly be raised, that trouble may be encountered on account of the inability to operate advantageously without ground connection a system originally designed for grounded work, is not a matter of great consequence. A well-planned transmission line must maintain its insulation, and it is certainly an open question whether it is not better to have a grounded line become inoperative immediately than to have it interfere with service for a brief period; the interference with service would ordinarily be of predominating importance.

An accidental ground on any phase of an underground supply system is pretty certain to lead to grave trouble. The main question is, therefore, whether the neutral should be grounded directly or through a resistance. In many instances it is desirable to use such resistance as to allow the circuit-breakers to trip before any further damage can be done. Practice tends toward low-resistance grounding. The one case considered by Mr. Peck in which grounding seems less important than anywhere else is that of generators of moderately high voltage connected directly to overhead lines. In this case the system may be operated for some time in the minor grounds on a single wire if the system is ungrounded. On such systems the practical factor of safety in the insulation is generally considerably higher than in the typical high-voltage transmission system, so that there is less to gain relatively by limiting the tension between wire and earth. Mr. Peck's consideration of the matter forms a good summary of the present state of the situation.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Western Association of Electrical Inspectors

(By Telegraph)

The eighth annual convention of the Western Association of Electrical Inspectors opened at the Planters' Hotel, St. Louis, Mo., Tuesday, Jan. 28, for a three-day session lasting until Thursday of this week. Special cars brought a number of the delegates to St. Louis from Chicago, where on Monday afternoon interesting fuse tests had been made at the Underwriters' Laboratories.

An attendance of seventy marked the first day's session at St. Louis. In his opening address Mr. W. J. Canada, Denver, Col., retiring president of the association, directed special attention to the improved uniformity of inspection methods now obtaining in the field, an improvement which he traced largely to the association's active work during the last eight years.

Following President Canada, Mr. F. A. Driscoll, of Pass & Seymour, Chicago, spoke on the subject of "Electrical Porcelain, Its Manufacture and Uses." Mr. H. B. Gear, Commonwealth Edison Company, Chicago, presented a paper on "High-Voltage Transmission-Line Requirements," and Mr. B. H. Glover, associate electrical engineer Underwriters' Laboratories, Chicago, discussed "Electrical Laboratory Test Problems."

Mr. W. H. Blood, Jr., Boston, Mass., insurance expert for the National Electric Light Association, was to have presented a paper on "The 660-Watt Branch Circuit and Its Relation to Mazda Lamps," but being unable to attend he sent a letter to the St. Louis convention in which he urged the adoption of 10-amp fuses for final circuits and the granting of permission to use household devices up to 1000 watts on any socket. For devices above that rating he recommended the adoption of special plugs. Mr. Blood also suggested the advantage of substituting No. 12 wire for the No. 14 ordinarily used for final circuits in buildings. He considered the limitation of sockets to twelve per circuit unnecessary in building wiring for the sake of electrical safety, although he thought such a limit might prove advisable from the standpoint of public danger, since the blowing of a single fuse would under these conditions result in extinguishing a smaller proportion of the total lamps in the building.

On Tuesday evening the Jovian Chapter of the St. Louis League of Electrical Interests tendered a very delightful entertainment to the visiting inspectors.

International Prize of $100,000 Offered for Gasoline Substitute

At a recent meeting in Paris, France, of the International Association of Recognized Automobile Clubs, which represents the whole of Europe and the United States, an international prize of $100,000 was announced for the best fuel other than gasoline capable of being used in an internal-combustion engine. The purpose of the prize offering is to interest chemists in the production of a fuel which cannot be monopolized by any nation or combination of national interests. Owing to the increasing price of gasoline, the substitution of a new fuel for gasoline motor drive has occupied the attention of many in this country. A few tests have been made at the laboratory of the Automobile Club of America, but up to the present nothing of a substantial nature has developed. Evidently there is a world-wide demand for relief from the present situation, which ought to contain much of interest for the electric-vehicle industry.

Electrification of Chicago, Milwaukee & Puget Sound Railroad

While nothing definite has been decided in relation to the engineering details of the electrification of the main line of the Chicago, Milwaukee & Puget Sound Railroad between Harlowton, Mont., and Avery, Idaho, it is said to be not unlikely that 2400-volt direct-current motors will be used on the electric locomotives, energy being supplied to them by means of an overhead system. As previously stated, electricity will be purchased by the railroad company from the Montana Power Company of Butte, which will generate it, normally, at hydroelectric plants. These generating stations are, or will be, located at Great Falls, on the Missouri River; at three sites on the same river near Helena, at a site on the Madison River, in the Rocky Mountains, and at Thompson Falls, on Clark's Fork. With a diversity of sources and excellent reservoir possibilities in some of the mountain sites, continuity of operation is anticipated.

The energy will be transmitted at 100,000 volts or thereabout and transformed to a lower voltage for distribution, and also probably changed to direct current, as mentioned. The electric zone of the railroad embraces 439 miles of single track with 11 or 12 miles of sidings. It embraces that portion of the railroad extending from the plateau of eastern Montana over the passes through the main ranges of the Rocky Mountains. The railroad is excellently built, but in some cases grades of 2 per cent are encountered. The electric locomotives will haul all classes of traffic, both freight and passenger. President A. J. Earling of the Chicago, Milwaukee & St. Paul Railway Company, which controls the Puget Sound road, is much interested in this electrification, which will be carried out under the direct supervision of Mr. C. A. Goodnow, vice-president.

Association of Corporation Schools

Representatives of a number of large manufacturing corporations which conduct schools for training employees in the technical branches of their work met at the New York University law school on Jan. 24 and perfected organization of the National Association of Corporation Schools, whose aim it will be to co-ordinate the educational efforts of its member companies. Mr. Arthur Williams, general inspector of the New York Edison Company, was elected the first president of the association, the vice-presidents chosen being Mr. E. St. Elmo Lewis, of the Burroughs Adding Machine Company, Detroit, Mich., and Dr. C. P. Steinmetz, of the General Electric Company, Schenectady, N. Y. Mr. Frederick C. Henderschott, 424 Broadway, New York City, is secretary. Annual conventions will be held by the organization.

In the evening nearly 100 members and guests attended

the association's first banquet, which was held at Delmonico's, with Mr. Lee Galloway presiding as toastmaster. In his address at the dinner President Arthur Williams referred to the work of the public-policy committee of the National Electric Light Association in bringing about a clearer realization of the justice of workmen's compensation, service annuities and employees' profit-sharing. Dr. C. P. Steinmetz spoke briefly, urging the need for the development of corporation educational standards up to the degree of efficiency already attained in the branches of production and administration. Chancellor Elmer E. Brown, of New York University, and Vice-President E. S. Lewis discussed the aims of co-operative education and the results to be achieved through the newly formed association. At the close of the dinner President Williams was the recipient of a unanimous vote of recognition and appreciation of the valuable and important work done by the New York Edison Company in the organization of its employees' schools.

Ratification of Wireless-Telegraph Treaty

Ratifications of the wireless telegraph treaty signed at London July 5, 1912, probably will be exchanged at the British capital within a few weeks by the thirty-one signatory powers. The Senate ratification of the treaty a few days ago paved the way for this formality, as practically all the other governments are understood to have approved the treaty, which will become effective July 1, 1913. By this convention the important maritime nations of the world have linked themselves together to attain the widest range of international usefulness of the wireless telegraph without restriction as to its further development. A full transcript of the London convention and the final protocol, together with an abstract of the regulations, was printed in the *Electrical World* for Sept. 28, 1912.

Tariff Hearings on Schedules B and C

The tariff hearings before the ways and means committee of the House of Representatives, which have extended through the month of January, have been marked in many cases by testimony to the effect that conditions in various industries have materially altered since the making of the last tariff bill. Representatives of various industries connected with electrical matters were heard during the consideration of Schedule B—"Earths, Earthenware and Glassware"—and Schedule C—"Metals and Manufactures of."

Rods and Wire

Besides altering the phraseology of the present act, as it applies to "telegraph and telephone wires, coated, and cables," the John A. Roebling Sons Company, representing nine wire manufacturers, asked for a reduction of 5 per cent (from 40 per cent to 35 per cent) on this item, in a brief filed on the subject. The petitioners referred particularly to wire rods, round iron and steel wire, flat wire and steel in strips, and articles manufactured from wire. High-grade products were referred to entirely, thus excluding common or tonnage products, such as fence wire, bale wire, nails and other run-of-mill product. High-grade products require more operations, heat treatments, picklings, inspections, etc., and a larger proportion of labor. In the matter of machinery about the same methods are employed at home as abroad, and these are comparatively simple.

The act of 1909, paragraph 134, provides duties of 0.3 cent per pound on all rods valued at 4 cents per pound or less and 0.6 cent on rods valued at more than 4 cents per pound; it further provides 0.5 cent per pound additional duty on rods tempered or treated in any manner, or smaller than No. 6 wire gage. Objection was made to Bill H. R. 18,642, which classifies finished products with rods and lowers the tariff. The suggested paragraph on rods was as follows:

"Wire rods, rivet, screw, fence and other iron or steel wire rods, whether round, oval, flat or square, or in any other shape, and nail rods, all the foregoing in coils or otherwise, 10 per cent ad valorem: Provided, That all the foregoing iron or steel wire rods, of whatever shape or section, which are cold-rolled, or cold-drawn, or cold-hammered, or polished in any way in addition to the ordinary process of hot-rolling or hammering, or that shall have been tempered or treated in any manner or partly manufactured, and all iron or steel wire rods smaller than No. 6 wire gage, shall be classified as wire and dutiable as such under the provisions of this act."

The proposed paragraph in relation to wire is next given:

"All wires composed of iron, steel or other metal, except gold or silver, whether rolled or drawn through dies or rolls, or otherwise produced, whether round or flat, oval, square, or in any other section or shape, in coils or otherwise, whether in long or short lengths; all flat wires, and steel in strips, whether in long or short lengths, in coils or otherwise, not thicker than No. 15 wire gage, and not exceeding 5 inches in width; all the foregoing valued at—

	Per Cent. ad Valorem
1¾ cents per pound and less	20
More than 1¾ cents per pound and not more than 2¾ cents per pound	25
More than 2¾ cents per pound	30

"Provided, however, That all wires composed of iron, steel or other metal, except gold or silver, covered with cotton, silk, enamel or other material, corset clasps, corset steels and dress steels; all iron or steel flat wire, and steel in strips, whether in long or short lengths, in coils or otherwise, not thicker than No. 15 wire gage, and not exceeding 5 in. in width, and all iron or steel wire other than round, valued at 6 cents or more per pound; all round wire of iron or steel in long or short lengths, in coils or otherwise, valued at 8 cents or more per pound; telegraph, telephone and other wires and cables composed of metal and rubber, or metal, rubber and other materials; wire heddles or healds; wire rope and all other articles manufactured wholly or in chief value of any of the foregoing or of any wire or wires provided for in this paragraph, on all the foregoing, 35 per cent ad valorem.

"Provided further, That iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin or other metal, and not otherwise specially provided for, shall pay, in addition to the rate imposed on the wire of which it is made, one-tenth of 1 cent per pound; provided that none of the foregoing or any of the articles provided for in this paragraph shall pay more than 35 per cent ad valorem."

Further provisions, not included above, related to fence wire. A plea was also made to maintain the present duty of 0.2 cent per pound, in addition to the duty on plain wire, for specially galvanized wire, known as double or extra-galvanized.

A synopsis of other hearings relating to incandescent lamps, carbon, aluminum, bauxite, mica and ferro alloys will appear in a later issue.

Mexican Hydroelectric Development

Work on the hydroelectric system of the Mexican Northern Power Company on the Conchos River, about 17 miles from Santa Rosalia, Mexico, which was held up for a time owing to the activities of the rebels in that section of the country, is again under way, and it is expected that the project will be finished about July 1, 1913. The Mexican Northern Power Company is a Canadian concern, with its principal office in Montreal, and, in addition to furnishing energy to a subsidiary company, the Mexican Securi-

ties Corporation, Ltd., of Halifax, Nova Scotia, it will build transmission lines to Chihuahua, Parral, Jiminez and other cities, besides carrying on a central-station business in each of those cities on its own account. The dam now nearing completion at La Quoila is stated to be one of the largest masonry structures in the world. Its height will be 261 ft. and its width at the crest 19 ft., the width of the bottom being 200 ft. The reservoir it will create will have a storage capacity of about 28,000,000,000 cu. m, which will flood an area of 58 sq. miles. Besides this main dam a subsidiary dam 2610 ft. long and 108 ft. high is being built about half a mile from the main dam.

The hydroelectric station, it is stated, will have a rating of more than 100,000 hp. The company has also in contemplation the irrigation of 200,000 acres of land in the valley of the Conchos River. Messrs. S. Pearson & Son of London, Eng., are the contractors for the enterprise. Mr. P. L. Bloston is the general superintendent, and Mr. William B. Buller is chief engineer of the work.

Revision of Standardization A. I. E. E. Rules

Before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, Mr. B. G. Lamme, of Pittsburgh, on Jan. 27 delivered an address on "The Desirability of Revising the Rating and Methods of Testing Electrical Apparatus." He did not have a prepared paper, but spoke extemporaneously, with the aid of notes. He devoted himself to the proposed revision of the standardization rules of the American Institute of Electrical Engineers.

Mr. Lamme gave a brief history of the standardization rules, and said that the trouble with them has been that they have followed practice but have never led practice. He told of the work of the sub-committees of the Institute on revision and ratings, and outlined some of the important changes which it is proposed to make in the rules. The sub-committees have found many defects in the present rules and some of the changes offered are radical. It has been proposed to submit these changes to the electrical public before embodying them in the rules. An Institute convention will be held in New York for this purpose on Feb. 26 to 28. (See *Electrical World* of Jan. 18, page 128.) At this meeting there will be presented some forty papers relating to the general subject of standardization. Mr. Lamme gave a general forecast of the report of the sub-committee on revision prepared by Dr. C. P. Steinmetz and himself.

The speaker said that there should be no standardization in design. Standardization should apply to methods and practice; it should give a definite meaning to a contract or a guarantee, so that there may be uniformity throughout the country. One thing referred to was the rating for alternating-current generators. It is the present practice to rate them at 100 per cent power-factor. This is incorrect; the power-factor should be specified. The sub-committees are trying now to make rules for rating that will be as useful, perhaps, five or ten years hence as at the present time. The sub-committees hope for a wide discussion of their work. Constructive criticism is desired.

Temperature and Insulation

Much of Mr. Lamme's address was devoted to the subject of temperature and insulation of electrical machinery. The old method of testing is held by the sub-committee on revision to be incorrect. Temperature rise in itself has no meaning. The temperature attained—the ultimate temperature—is what is important. The new rules make the ultimate temperature the basis of the rating, for it is the absolute temperature that is liable to damage the insulation; the rise is only an incident.

The effect of heat on insulating material is largely mechanical. The insulation becomes brittle and mechanically unfitted for its purpose, as it is largely a separator to keep the conductors apart mechanically. Insulation may be heated until it is carbonized and still retain a good degree of dielectric strength, but its mechanical resistance is gone. Durability of insulation is a function of the temperature, but there is no such thing as a definite life to insulation. Insulation in electrical machinery has been withstanding higher temperatures than has been thought, because methods of measurement have been defective. Fibrous types of insulation will probably withstand 100 deg. C. continuously for ten years or more. The sub-committee has assumed 100 deg. as the highest temperature that can be applied continuously for a long life. Intermittent application of heat to insulation permits of higher maxima of temperature than steady application.

There is no direct method of determining the ultimate temperature of the hottest parts of insulation in a machine. The speaker described the commercial method of partly measuring and partly computing this temperature—measuring by thermometer and resistance and computing by the laws of temperature drop in insulation, which are pretty definite. In the conventional methods of measuring temperature the result attained is always lower than the temperature of the hottest part. It may be assumed, for instance, that if the conventional measurement is 90 deg. the temperature of the hottest part will be 100 deg. Taking 90 deg. as the conventional limit and 40 deg. as the temperature of the outside air, a rise of 50 deg. is permitted. However, if the customer using the machine desires to put in a method of cooling to run his generator at, say, 25 deg. C., he should have the advantage of so doing. The rating should still be at 100 deg. in the hottest part for continuout operation, or 90 deg. by conventional measurement.

As to the temperature of the "surrounding air," Mr. Lamme pointed out that what is to be taken into account is the temperature of the air going into the machine, not generally of the surrounding air. If a machine is in a pit or in an unventilated corner there is considerable difference between these two terms. The old rules are defective in this respect.

There may be difficulty in ascertaining the internal temperature of machines. This is particularly the case with a large high-voltage machine with a long core. Here it is not practicable to use ordinary fibrous insulation, and this has led to the use of mica insulation on the buried parts of such machines. Mica insulation in machines will withstand 125 deg., conventional measurement, for continuous operation, as well as fibrous insulation will withstand 90 deg., conventional measurement. In the new rules it is proposed that mica insulation in machines be allowed an ultimate temperature of 125 deg. by conventional measurement.

The proposed method of rating will permit of machines being loaded more closely to their limit than the present rules. In low-voltage machines the new rating will be determined when the hottest part is at 100 deg. C. for continuous operation. At that temperature the absolute rating of the machine will be determined. There will be no "peak" rating or "full-load-for-two-hour" rating; simply one absolute rating. Speaking of overload ratings, the speaker said that the idea here is generally a fallacious one. The designer of the machine must plan for the peak condition. There is no use in building a 3000-kw machine and calling it a 1500-kw machine to get 100 per cent overload for two hours. However, momentary peaks do not affect temperature materially; the time element must enter in.

Measurement of Losses and Efficiency

In relation to the method of measuring losses in electrical machinery and the determination of efficiencies, Mr. Lamme said that the input-and-output method is really not scientific. It involves the using of large units of measure-

ment to determine relatively small losses. A small error in observation or calculation may make a serious difference. The separate-loss method of measurement can be made more accurate than the other, but it requires a correcting factor. However it is better adapted to commercial conditions. It is expensive to make a good input-and-output test on a large unit, and the results are not accurate enough to be worth the cost. In the new rules the separate-loss method, with correcting factor, will be recommended. This method is particularly well adapted to the testing of induction motors and rotary converters. It is also very well suited to the testing of transformers.

Discussion

Mr. W. B. Jackson, Mr. Hugh Pattison, Prof. W. C. Bauer, Prof. P. B. Woodworth, Mr. B. H. Glover and others took part in the discussion. Mr. Jackson spoke in appreciative terms of Mr. Lamme's work and pointed out that the proposed rules will not only furnish a manual for testing but will have a deeper object in pointing out the most economical method of designing and operating electrical machinery. He said the committee should be encouraged and helped. Mr. Glover asked what the ultimate life of insulation for electrical machinery was. Mr. Lamme answered that in machine insulation fibrous and cellulose materials are in one class and mica and similar materials in the other. In the first case an ultimate temperature of 100 deg. in the hottest part of the machine would give a relatively long life, probably ten or fifteen years. In the mica class it is not known how long the life would be with an absolute temperature at a continuous rating of 125 deg. or even 150 deg. in the hottest part. Mica insulation has been operated at these temperatures for four or five years without showing any sign of trouble.

Hydroelectric Development on the Connecticut River at Windsor Locks, Conn.

The Senate committee on commerce has reported favorably on the bill authorizing the Connecticut River Company to relocate and construct a dam across the Connecticut River above the village of Windsor Locks in the State of Connecticut. The interesting feature about the bill is the proviso authorizing the Secretary of War to impose a reasonable annual charge to be paid by the corporation for the privilege granted, these proceeds to be used for the development of navigation on the Connecticut River and the waters connected therewith. For years the federal government has been importuned to improve this portion of the Connecticut River so as to permit navigation to pass around the rapids which obstruct the river at Windsor Locks, but the board of engineers to which the project has been referred has uniformly reported that the expense of such an undertaking would be so great as to make it inadvisable for the federal government itself to assume the burden. Under the present bill this burden is assumed by the private company which is to develop the water-power.

A basis of agreement has been reached with the company under which its books, showing all the actual expenses of the enterprise, are to be open to the government and the profits from the sale of water-power are to be carefully tabulated and accounted for under standards subject to the approval of the board of engineers. The company is to receive the net profits derived from its investment to an extent of 8 per cent on the actual cash invested. Thereafter all further net profits are to be divided between the government and the company. Between 8 and 9 per cent they are to share equally, and beyond 9 per cent the government is to share in an increasing ratio. Furthermore, in order to provide for a possible increase in the profits of such business, as years pass and water powers may increase in value, the Secretary of War has insisted that after thirty years under the present arrangement there is to be a readjustment of compensation by agreement between the government and the grantee, and that thereafter such readjustment is to take place at the end of every ten years, until the termination of the permit, the life of which is fifty years altogether.

A minority committee report, while favorable to the measure, suggests the elimination of the federal rental clause on the ground that it is an attempt, under the guise of regulating commerce, to invade the settled rights of the State for commercial purposes. This principle, it asserts, if established, will confiscate the natural resources and property of the States and of their citizen riparian owners, without a legal right or a moral right to do so. In the estimation of the minority the adoption of the principle will create a divided responsibility, causing two sovereign powers to attempt to regulate and control the same question at the same time, and will grant to the Secretary of War discretionary powers never contemplated under the commerce clause of the Constitution.

Annual Conference of National Civic Federation

The thirteenth annual conference of the National Civic Federation was held at the Hotel Astor, New York City, Jan. 28 and 29. The speakers at the opening session were Messrs. Seth Low, president of the federation; Emerson McMillin, chairman of the department on regulation of interstate and municipal utilities; Alton B. Parker, William R. Willcox, Public Service Commission, First District, New York, and John B. McPherson, secretary of the New England Civic Federation, who read a paper prepared by Mr. August Belmont on workmen's compensation laws. The afternoon session was given over to a discussion of proposed pension laws, a three-cornered debate being held by Messrs. F. S. Baldwin, former chairman of the Massachusetts State Commission on Pensions, G. T. Morgan, chairman of the executive committee of the United Civil Service Annuities Association, and Arthur Williams, of the New York Edison Company.

In his opening address Mr. Low said that the present method of dealing with the trust question is merely playing with the situation. He suggested that there be a specific acknowledgment that all restraint of competition is not necessarily restraint of trade, and favored a federal license for state-created corporations, because that is the path of least resistance and because if it be successful it involves the least radical departure from what already exists. To an interstate trade commission such as he thought should be established Mr. Low would not give at first authority to fix prices. The commission would have power to decide what was legal under the Sherman act. He argued that if the details were criticised by the commission changes could be made to overcome the commission's objections.

Mr. Emerson McMillin in his report said that the principle of public regulation of quasi-public undertakings is firmly established in this country. The Massachusetts Board of Gas and Electric Light Commissioners antedates the Interstate Commerce Commission and is now almost thirty years old. Congress established a commission to regulate interstate railroads in 1887. Forty-two of the forty-eight states of the Union to-day have commissions of one kind or another exercising central supervision over railroads or local public utilities, or both.

The old idea that the purveyor of transportation, gas, water, electricity and other public services under modern conditions was engaged in a private business, subject to the same rules of bargain and sale as the dry goods merchant, the butcher or the manufacturer, no longer prevails. Competition, relied upon in the earlier days to protect supposed public interests, has failed; competition in a public

service business is war. The furnishing of a transportation, gas, water, electric, telephone or other public service is, and should be, he said, naturally a monopoly. Unregulated monopoly in any field of endeavor is abhorrent to Anglo-Saxon people. While regulation of public utilities must be based on full recognition of the monopolistic character of the business, it is also true that recognition of monopoly invites public regulation or public ownership and operation. The department believes that not only public regulation is preferable to public ownership and operation, but that public ownership and operation may be deferred only by reasonable public regulation. The state owes it to its quasi-public agencies performing the transportation, gas, water, electric, telephone and other public services no less than to the public itself to free public utilities from the baneful influence of local politics. The state must see to it that the common-law rule of reasonableness and non-discrimination is applied fully and in all respects fairly to these industries. The efforts of the department have been directed to the drafting of a sample bill, which is now nearing completion, and will be available as a sample for use in all states in the country which have not as yet legislated on the subject and in other states which are proposing to revise existing legislation.

Public Service Commissioner Willcox's report on welfare work was read by the secretary of the welfare department of the federation. As signs of the advancement of welfare work, Mr. Willcox's paper pointed to the better sanitary conditions in many factories, particularly as regards medical inspection to ascertain tuberculosis; a generous introduction all over the United States of playgrounds, and the introduction by many firms of life-insurance funds for their employees. Efforts are under way, Mr. Willcox reported, to obtain a higher minimum wage for department store employees.

The discussions on Jan. 29 were devoted to the federation's proposed amendments to the Erdman railway conciliation act and upon a proposed model state mediation act. This discussion was led by Messrs. Marcus M. Marks, Samuel Gompers, Labor Commissioner Charles P. Neill, James M. Lynch, State Commissioner William G. Rogers, W. G. Lee and W. Z. Ripley. Mr. William Jay Schieffelin discussed the protocol in the local garment trades at the afternoon session. There were also a debate on "The Practicability and Desirability of Minimum Wage Required by Law," and a paper by Mr. Ralph M. Easley on "Industrial and Civic Progress in the United States."

Society of Heating and Ventilating Engineers

The annual meeting of the American Society of Heating and Ventilating Engineers was held in New York City Jan. 21, 22 and 23, with Mr. John F. Hale, of Camden, N. J., first vice-president, occupying the chair in the absence of President John R. Allen, of Ann Arbor, Mich., who is in Turkey. President Allen nevertheless forwarded his presidential address, which discussed "Development and Present Problems of Heating and Ventilation." Reports by Secretary W. W. Macon, New York, and Treasurer J. A. Donnelly, New York, showed the flourishing condition of the society, with $1,041 cash on hand, and a membership of 449, an increase of twenty-four over last year.

After hearing from various state chapters, the report of the committee on compulsory legislation was read. Prof. J. D. Hoffman, University of Nebraska, Lincoln, is chairman of this committee, which comprises twenty-one members. The ideal law outlined in the report is designed for the guidance of state legislators and provides for proper heating and ventilation of all buildings of a public nature (whether publicly or privately owned), containing rooms used as meeting places, study rooms, rest rooms, sick rooms or wards, laboratories, workshops, cloak rooms, etc.

The proposed law would require 65 deg. to 70 deg. Fahr. in offices, assembly halls, recitation and sick rooms, 60 deg. to 65 deg. in gymnasiums and 60 deg. to 70 deg. in corridors, workrooms, toilets, etc.; more than 5 deg. variation being in no case permitted. Where dust or other matter is likely to render the ventilating air impure filters or washers must be installed. Mechanical ventilation plants must also provide means for holding the humidity between 50 per cent and 70 per cent. Ventilation requirements given are as follows: In general, at least 200 cu. ft. of air space, or 15 sq. ft. of floor area, for each person. For sick rooms, contagious diseases, 3600 cu. ft. air per hour per person; non-contagious, 2500 cu. ft. Auditoriums, schools, etc., 1800 cu. ft. For each cubic foot of gas burned 1000 cu. ft. air per hour per person. Rooms not meeting the general minimum requirements, and having a window area less than one-eighth their floor space, must be artificially ventilated during occupancy. Air velocities employed must not exceed 400 ft. per minute at registers, 700 ft. in vertical ducts or 400 ft. in mechanical air washers.

REQUIREMENTS IN MOTION-PICTURE-THEATER VENTILATION.

	Single Machine	Two Machines	Three Machines
Exhaust ventilation, cubic feet per minute	60	90	120
Metal-screened inlet openings, with fusible-link dampers, area, square inches.	180	210	240
Fireproof flue from booth, discharging outside, area, square inches.....	96	120	144

A paper by Mr. E. Beery, Rockford, Ill., described the use of downward ventilation in a local school building. "Improved Air Conditions in a Boston Residence" was the title of a paper read by Mr. Frank Irving Cooper in which he described an installation employing electric radiators, humidifying, air-washing and ozonizing apparatus. The author, as chairman of the committee on schoolroom ventilation, also presented that committee's report.

On Wednesday morning Mr. Frank Busey read a paper, "Design of Indirect Heating Systems with Respect to Maximum Economy and Operation," prepared jointly with Mr. W. H. Carrier. Dr. M. W. Franklin, Schenectady, N. Y., next discussed applications of ozone for ventilation, deodorizing, water purification, etc.

The report of the committee on ventilation of motion-picture theaters was presented by its chairman, Mr. F. T. Chapman. The legislation recommended imposes a minimum of 4.33 sq. ft. seating area per occupant, exclusive of aisles; 80 cu. ft. of air space per occupant; air supply of 15 cu. ft. per minute per occupant, and a temperature of 62 deg. to 70 deg. Fahr. at the breathing line, the persons being seated. Inclosures for the projecting apparatus must fulfil special requirements, depending on the number of machines used, as shown in the accompanying table.

Mr. Frank K. Chew, New York, presented his paper, "An Analysis of a Combination Heating System for a Residence," on Thursday morning. The afternoon session was given over to a discussion of the report of the committee on legislation, its draft being returned with suggested changes. Mr. J. A. Donnelly, New York, also supplemented the report of the committee on tests.

At the Tuesday evening session the election of officers was announced as follows: President, Mr. John F. Hale, Camden, N. J.; vice-presidents, Mr. E. F. Capron, Chicago, Ill., and Mr. A. B. Franklin, New York; treasurer, Mr. J. A. Donnelly, New York; managers, Messrs. F. T. Chapman, Ralph Collamore, D. D. Kimball, W. W. Macon, J. M. Stannard, Theodore Weinshank, John R. Allen and R. P. Bolton. The annual banquet was held Wednesday evening at the Hotel Martinique. Among the speakers were Mrs. Florence Kelley, secretary of the National Consumers' League, and Mr. John Martin, of the New York Board of Education.

Ferranti on Prime Movers

The lines along which the prime movers of the future are likely to develop were discussed by Mr. S. Z. di Ferranti, the distinguished English central-station engineer and inventor, in his James Watt anniversary lecture, delivered at Greenock, a suburb of Glasgow, Scotland, Jan. 16. Referring to the Diesel or heavy-oil engine, the speaker expressed the opinion that for large powers this is the wrong principle to employ, insisting that any reciprocating machine is probably only a makeshift pending the solution of the problem by a rotary engine. Mr. Ferranti also gave an account of his new high-temperature re-superheating turbine and dealt with the fuel problem of the British Navy as a matter of national domestic economy.

Sebastian Ziani di Ferranti, twice honored with the presidency of the Institution of Electrical Engineers of Great Britain, is well known as one of the great pioneers in the development of the electrical industry. He was the first to advocate the central-station idea in Great Britain, using high-tension transmission and distribution, and in 1889 built a 10,000-hp, 10,000-volt alternator which gave satisfactory service in the Deptford station, London. This installation employed 10,000-volt underground cables with concentric conductors, the outer being grounded. Mr. Ferranti is a director in the firm of Ferranti, Ltd., Hollinwood, Lancashire, and had recently accorded to him one of the few honorary memberships ever granted by the American Institute of Electrical Engineers.

After tracing the development of the steam engine from the days of James Watt and his patron, Matthew Bolton, up to the invention of the steam turbine by Sir Charles Parsons, the speaker referred to the principles involved in the operation of internal-combustion engines. Practically all of the power of steam is available for useful work, for the power required to pump water into the boiler, the "negative work" of the cycle, is small. Explosive-mixture engines, in which the charge is compressed before being fired, belong, however, to the class of prime movers with "high negative work," since the engine friction and the work of compression must be subtracted from the energy of the explosion. These negative quantities are very serious and would render this class of motor useless were it not for high mechanical efficiency. In the gas engine the negative work is high but not so high as to form a serious difficulty. In the more economical Diesel engine, in which very high pressures are used to get a temperature high enough to burn the oil as sprayed into the cylinder and give large expansion, the negative work is more serious.

Had the engines of high negative work been invented in the days of James Watt they could never have been made workable, for the materials available at the time would not have stood the temperature, and mechanical knowledge and construction were not sufficiently advanced for that high degree of mechanical efficiency necessary with engines of this class.

At the present time the internal-combustion engine and the steam turbine are competing for premier place in furnishing the world's power. The turbine, though less economical in actual fuel consumption, has many great advantages and for large powers is to-day practically unassailable. For small powers the turbine is naturally uneconomical.

From a careful and dispassionate consideration of the subject, said the speaker, it seems, according to present knowledge, to be clear that for small powers the internal-combustion reciprocating engine is in every way the best. At the other end of the scale the turbine is the only means of filling our requirements to-day. Between these two extremes there is a doubtful dividing line where either form of engine may best serve the purpose according to the conditions of the particular case.

As the turbine gets bigger it becomes easier to construct and is also more economical. As the gas or oil engine gets larger the natural difficulties increase. On the other hand, as the turbine is reduced in power its economy falls off badly and it is difficult to make of a satisfactory design. The internal-combustion engine, however, becomes a most satisfactory and economical machine in small sizes, as witness the thousands of gas engines in use all over the world and the beautiful engines working on the Diesel cycle which are small enough to avoid water-cooling of the pistons.

This division of the means of power production by large and small units between the rotary and reciprocating machine, according to Mr. Ferranti, seems to be almost a natural law, and those who seek to evade it must either invent some new principle or court endless trouble, expense and failure. To-day, with a complete disregard of the above principles, the advocates of the Diesel engine for marine propulsion are spending vast sums of money on its development, but even this usually all-powerful force, he insisted, may not prove enough to make a wrong principle right. Few people, indeed, have any conception of the failures and breakdowns which have occurred and which are repeatedly occurring with the big experimental engines that have been constructed.

Referring to his own interest in prime-mover development and his work on the rotary-turbine principle, Mr. Ferranti pointed out that it is, of course, well known that the higher the temperature of the working fluid the higher the economy that can be obtained. High temperatures have, however, proved very difficult to work with, as is instanced by the low working temperatures of marine turbines. Seeing, however, that the difficulties were mechanical and that great advantage could be derived if these troubles were overcome, the author commenced experimenting some years ago, and now, after many failures and the expenditure of much money and time, has produced a turbine which, at the highest temperatures and with great and rapid variations of temperature, he feels is quite free from mechanical troubles. Indeed, he believes that this turbine is perhaps the strongest from a mechanical point of view that has yet been produced. Moreover, contrary to what might have been expected with a high-temperature machine, it runs with certainty with a blade-end clearance so small as to be almost negligible in point of leakage loss. Fear of possibility of stripping appears also to have been effectively removed.

In this turbine the steam is superheated initially, and then after the first expansion and while still superheated, it is re-superheated before it does its work in the second stage of the turbine. After this it is exhausted in a superheated condition through a regenerator to the condenser. The whole of the blading is electrically welded, avoiding strains due to calking at the high temperatures reached and also any loosening due to the same cause. The blading is of mild steel with a thin coating of pure sheet nickel electrically welded onto the surface. The blading is most accurately finished to shape by a process of step-by-step pressing under very heavy pressure and is welded in position with accuracy by an automatic machine, thus giving every opportunity for realizing the best results. Although the turbine is of the reaction type, no balance dummy is used. The whole of the end load is taken on a specially constructed thrust, thus saving steam leakage.

The steam is worked as a gas at high temperature throughout the turbine, and this, coupled with the many improvements above referred to, has given very good results.

A 5000-hp machine, after prolonged operation, has, when tested at a load of two-thirds full rating, given a shaft-hp on 7 lb. of steam. Supplied by an oil-fired boiler superheater system of 85 per cent efficiency (already exceeded in central-station practice), the turbine would therefore consume less than 0.625 lb. of oil per shaft-hp.

From many tests already made it appears that when the turbine is run at full load under favorable conditions it

will take less than 6 lb. of steam per shaft-hp, and that the system under the conditions named will have a thermal efficiency of over 24 per cent, corresponding to an oil consumption of about 0.55 lb. of oil per shaft-hp. Tests are now being carried on, although the turbine is run continuously in supplying power to large works. With a constantly varying load, according to Mr. Ferranti, this system when applied on a large scale will be capable of giving an overall thermal efficiency of 29 per cent.

When the advantages of the turbine system in the way of lightness, simplicity and certainty are borne in mind, and when they are compared with what is known of the complicated reciprocating oil engines now being introduced for marine purposes, the possibilities of the new system of high-temperature gas-steam turbine become of great interest. With the high-temperature steam turbine of large size generating electricity to supply power for all purposes on land, one gains the advantage of a machine of the highest efficiency which is not limited to oil for its fuel. It is probable that as improvements are made the whole of the coal used for firing these large units will be gasified and the by-products recovered. When this result is brought about we shall have not only an ample and cheap supply of fertilizer for the land, but also a great quantity of tar oils for naval purposes and an ample supply of benzol for small-motor requirements. This, the author feels, is the solution of the fuel problem for these motors rather than the production of alcohol on a large scale from the land, as has lately been advocated.

The electric motor which gives its output in rotary form and which is supplied with energy from very large stations is displacing all forms of small engine. It is therefore probable that in the future small prime movers will be required only to propel cars and boats, and that all stationary motors will be electric. The electric motor with its one running part so easily and conveniently applied to all purposes is a good illustration of the desirability and even the necessity of the rotary principle of engine. Reciprocating forms of engine will no doubt be used for a long time, but they can only be regarded as makeshifts, and so soon as an equally efficient machine for any particular purpose is developed it must surely displace the reciprocating motor. It is difficult to predict the form of the prime mover of the future, but in search of the highest economy and with the limitations of temperature imposed by known materials, one is inclined to look to electricity, converting the energy of the fuel at low temperatures and giving its power in rotary form, as the most likely eventual solution.

Merz Meter Patent Upheld by Court Decision

Judge Day, of the United States District Court for the Northern District of Ohio (Eastern Division), handed down a decision on Jan. 15 in the case of the Minerallac Electric Company of Chicago, complainant, against the Cleveland Electric Illuminating Company and Mathias E. Turner, defendants. The suit was brought for alleged infringement of the first four claims of the Merz patent, No. 722,030, assigned by the patentee to the complainant. The patent in suit is designed to provide for an instrument which will not only integrate and register the entire amount of energy used by a consumer of electricity during the entire period charged for, as one month, but which will also integrate and register the maximum amount of energy consumed in a definite shorter interval of time, which should be one of a certain number of equal intervals of time into which the long or charged-for interval is divided. The court says that it appears plainly from the record that if the first four claims of the Merz patent are held to be valid, the defendants' device is an infringement.

In his opinion the judge gives an interesting history of the development of that class of meters which not only integrate and register the entire amount of energy used by a consumer during the time charged for, but also integrate and register the maximum amount of energy consumed in a definite, shorter interval of time. The Merz instrument is then described, and the court finds that the defendants' structure and the complainant's structure are alike in their mode of operation and their result. Brown & Williams, of Chicago, were the attorneys for the complainant, and Hull & Smith, of Cleveland, and Howson & Howson, of New York, were the attorneys for the defendants.

Annual Meeting of American Museum of Safety

On Jan. 23 the American Museum of Safety held its annual meeting in the Engineering Societies Building, New York. In opening the meeting President Arthur Williams read several communications, including one from Dr. Rathenau, of Berlin, expressing appreciation of Edison's services to humanity; an announcement of the new E. H. Harriman memorial gold medal, offered annually by Mrs. Mary W. Harriman through the Museum of Safety to the American steam railway making the best record in accident prevention and industrial hygiene, and a message from the director of the Museum of Social Service, of Budapest, congratulating the American Museum on its work.

President Williams then delivered the annual address, describing the field and the activities of the Museum, which was organized in 1908 and incorporated in 1911. He dwelt at length on the needs of the Museum, both in financial support and in respect to larger quarters than those at present occupied in the Engineering Societies Building.

Mr. Andrew Carnegie was then presented and spoke briefly of his personal pleasure over the work being done in promoting industrial safety. He was profoundly impressed, he said, with Mr. Williams' facts and statistics and voiced his belief that the general progress of humanity is improved, as evidenced, among other things, by the work of the Museum.

Mr. T. C. Martin, chairman of the executive committee, made a stirring appeal for support of the cause, emphasizing the great need for much larger and more pretentious quarters and additional funds to widen the scope of the work. The annual budget last year was about $25,000.

Dr. N. E. Ditman then spoke briefly on occupational disease and hygiene. Other speakers were Dr. G. F. Kuntz, chairman of the plan and scope committee, and Mr. A. A. Anderson, chairman of the educational committee.

The award of medals was made by Prof. F. R. Hutton, who spoke briefly of the achievements of each of the four recipients. The *Scientific American* medal was awarded to the Draeger Oxygen Apparatus Company for the pulmotor, as an agency for saving life which without it would be forfeited. The recipient was Mr. F. F. Morris, president of the company. The Travelers' Insurance medal was awarded to the New York Edison Company for persistent effort and success in minimizing the dangers of employment in electric generating plants and distribution systems. Mr. John W. Lieb, vice-president and general manager, received the medal in behalf of his company. The Louis Livingston Seaman medal was awarded to the National Cash Register Company for achievement and success in securing factory hygiene and sanitation. The Rathenau medal was awarded to Mr. Thomas A. Edison for achievement in electrical devices to make safe the lives of workers in atmospheres charged with combustible or deadly gas. On account of Mr. Edison's unavoidable absence the medal was received by Mrs. Edison, who was greeted with prolonged applause. The Edison electric safety lamp, primarily for miners' use, which was the specific achievement for which the medal was bestowed, was described in our issue of last week.

The meeting closed with an interesting illustrated lecture

by Dr. W. H. Tolman, director of the Museum, on safety devices and appliances now in actual use in various industrial plants. Two days after the meeting announcement was made public that Mr. Carnegie had given the Museum the sum of $5,000 to carry on its work.

Control and Regulation of Niagara River

Hearings were held on Jan. 22 and 23 before the House committee on foreign affairs on the new bill controlling the diversion of water on the American side of the Niagara River and the importation of electricity from Canada. The Burton act expires by limitation on March 4, and a fight is in progress to take from the federal government the control of the diversion of water in navigable rivers and, in the Niagara Falls case, invest it in the State of New York. The Secretary of War has appointed a board to report upon the problem of diversion of water from Niagara Falls, consisting of Lieutenant-Colonel Mason M. Patrick, Colonel Francis J. Kernan and Major Charles Keller.

The treaty between Great Britain and the United States authorizes the United States to permit the diversion of not more than 20,000 cu. ft. of water per second, while the Canadian government is empowered to authorize the diversion of not more than 36,000 cu. ft. per second. At present the diversion on the American side of the Niagara River aggregates 15,600 cu. ft. per second. The bill now before Congress does not permit the diversion of any more than that amount, and whereas the Burton act permitted the importation of a maximum of 350,000 hp from Canada, the present bill limits the amount to 200,000 hp. It also makes it obligatory for the generating companies to utilize the water at its maximum efficiency and stipulates that the companies receiving permits for the transmission or delivery of electrical energy shall be regulated as to rates, etc., by the Public Service Commission of the State, or where such a commission is lacking by the Governor of the State.

At the hearing on Jan. 22 the State of New York through its Attorney-General claimed that, after the government has decided how much water may be diverted from the Niagara River, it is entitled to control the diversion of the water and to decide the parties to whom it shall go. It was contended that while the federal government has a right to determine the quantity of water that may be diverted from a boundary stream in the exercise of its constitutional rights to control navigation, that power is exercised pursuant to that constitutional right only for the purpose of regulating and controlling navigation and for no other. Moreover, it was asserted by the State of New York that the federal government has no right to say how much power shall come into the State of New York from Canada or what shall be done with it, any more than it has the right to say how many bushels of wheat shall come in from Canada or to regulate the price or amount of imports.

The junior Senator from New York said that the State in its sovereign capacity remains the owner of all its property, subject only to the exercise of all of those rights or provisions which the State voluntarily transfers to the federal government, such as, for instance, to promote navigation, make treaties and provide for the common defence. The president of the New York State Conservation Commission expressed opposition to any legislation which will permit the existing generating companies to get any additional water from Niagara Falls. He said that the present policy of the State is to utilize all the undeveloped water-powers for the benefit of the people generally, and to utilize whatever water is available at Niagara Falls for the generation of electricity which is to be transmitted to the various municipalities and through them to the ultimate consumer at practically the cost of its development. He also maintained that true conservation presupposes the utilization of all water at its maximum efficiency.

It was brought out at the hearing that the taxes of the Niagara Falls Power Company to the State and municipalities aggregate $3 per hp, while the Canadian government charges practically $1 per hp. The Cataract Power & Conduit Company, which distributes Niagara energy in Buffalo, pays the Niagara Falls Power Company $16 per hp-year and sells it at practically $25 per hp-year, the difference being used to pay all the charges of transformation and transmission to Buffalo and its distribution in that city. It was pointed out that whereas the Hydro-Electric Power Commission of Ontario pays $9.40 per hp-year for energy to the Ontario Power Company as against the $16 charged by the Niagara Falls Power Company, the latter charge is for energy transmitted to Buffalo while the former charge is for energy delivered at the terminals of the transforming apparatus, or practically at the power house. It was said that by limiting the amount of energy that can be imported from Canada into the United States Congress has glutted the Canadian market with cheap energy. The secretary of the Niagara Falls Power Company stated that his company had had offered to it by the Hydro-Electric Power Commission of Ontario the same opportunity as the Ontario Power Company and refused to sell energy at $9.40 per hp-year, claiming that it would be unprofitable even at approximately $14 per hp-year. He also pointed out that the Ontario Power Company generates 17 hp for every cubic foot of water per second that is used, whereas the Niagara Falls Power Company is able to generate only about 11½ hp for every cubic foot of water per second used.

The counsel for the New York State Conservation Commission asked the committee on foreign affairs to consider the following three propositions: First, to render available for use all of the water granted by the treaty; second, if Congress has the power to do so, to compel the companies to submit themselves to the jurisdiction of the controlling powers of the State of New York; third, to have Congress give that controlling power in New York an opportunity to say what shall be done and what price shall be given for the energy after it comes into the State. The member of the committee on foreign affairs from Texas pointed out that as a matter of conservation the companies which are already in possession at Niagara Falls and have the machinery and equipment are in a very much better position to give cheaper energy to the people than others that have no equipment whatever.

As the result of a protest from New York state officials who declared that the passage of the bill, instead of conserving the falls, would practically place them in the hands of water-power sharks, the favorable report on the bill by the House foreign affairs committee has been postponed from day to day and another hearing will be held before the bill is sent to the House for action.

New Patent Bills Before Congress

The first attempt made to carry out one of the principal recommendations in the report of the Economy and Efficiency Commission on the Patent Office has been made by Representative Buckley, of Ohio, who has introduced in the House of Representatives a bill to appropriate land in Washington now owned by the government for the construction of a new building for the office to cost $4,000,000.

It is the intention of Washingtonians to make a strong fight on the bill, for the reason that it attempts to convert land which has already been set aside by the government for park purposes into a building site. There would be no objection otherwise to the bill, it being well understood and realized that a new Patent Office is a necessity.

Representative Buckley has also introduced in the House two other bills dealing with patent matters. One is a substitute for the other in that it combines the provisions of both bills. It is known as H. R. 28,286, and amends Sec-

tion 4931 of the Revised Statutes so that design patents may be granted for the term of seven years, or for fourteen years, as the applicant may elect. Section 4934 of the Revised Statutes is also amended so that the fees will be as follows: On filing each original application, except in design cases, $20, and upon issue, $20; in design cases, $15 for a seven-year grant and $30 for fourteen years; for applications for re-issue, $30; upon filing disclaimer, $10; on first appeal from primary examiners to examiners-in-chief, $10; on every appeal from examiners-in-chief to the commissioner, $20; for certified copies of patents, 10 cents per 100 words; for recording assignments, agreements, power of attorney or other paper relating to a single invention, 300 words or less, $1; over 300 and under 1000 words, $2; for each additional 1000 words, $1, and for each additional invention included in one writing, 25 cents; drawings at the reasonable cost of making them.

Representative Buckley is of the opinion that a small bill of this character stands a better chance of early passage than do the more voluminous and comprehensive bills now before the House and in the patent committee.

Hydroelectric Power Negotiations at Westfield, Mass.

The Amherst Power Company, operating a high-tension transmission system in the Connecticut Valley of Massachusetts, is negotiating with the municipal lighting commission of the town of Westfield for the shutting down of the existing municipal steam plant and the purchase and distribution of energy generated at the Turners Falls hydroelectric and Easthampton steam turbine stations of the company. Westfield is a town of about 16,000 inhabitants and is noted as the chief whip-manufacturing town in the world. The Amherst company originally proposed to supply the municipal electric-light plant with whatever energy was required for its present lighting and small power business, and to secure a franchise to sell energy in a wholesale manner to the manufacturers of the community, quoting the usual schedule to the latter and selling to the municipality at a low rate. Following the presentation of this program, the plan was suggested of having the town purchase the entire supply of energy required from the Amherst company, and negotiations are now proceeding on this basis. The company proposes to sell energy to the town at a rate which will save the latter many thousands of dollars yearly, permitting the writing off of the value of the existing municipal plant and enabling the town to quote low rates to the manufacturing interests and to other classes of consumers. The company is prepared to cooperate with the manager and municipal plant commissioners in building up a large business in the supply of electricity and in locating new industries in the town. It is agreed that the town cannot produce electricity in its own plant at a cost which will permit it to offer attractive rates to consumers.

Requirements for Successful Timber Treatment

Dr. Herman von Schrenk, of St. Louis, consulting timber engineer, presented a short paper at the recent Chicago convention of the American Wood Preservers' Association on "Requirements for Successful Timber Treatment." He said that in order to get good results from treated timber the following points must be observed: (1) Only perfectly sound timber should be treated; (2) properly seasoned material should be used; (3) a good preservative is essential to long life; (4) proper injection as to quantity and penetration is essential, and (5) proper subsequent handling of the timber is essential.

In reference to the relations that should exist between a wood-treating company and its customers, Dr. von Schrenk said: "I wish to protest against the tendency which requires the actual treating operation to be conducted in accordance with any demands which may be made by the customer, not only because this gives disappointing results so far as any particular piece of work is concerned, but also because it reacts on the company doing the work and on the industry as a whole."

Public Service Commission for Texas

A bill creating a State public utilities commission has been introduced into the Texas Legislature by Mr. Dwight L. Lewelling. The measure, which has been patterned largely after the public utilities laws of the State of Wisconsin, provides that the public utilities in Texas shall be placed under the control of a separate commission composed of three persons, to be elected by the Senate and House of Representatives in joint session. The commission is to have adequate powers, and the proposed law provides for appeals from its orders to the courts but forbids the setting aside of any order or suspension thereof by injunction pending the decision of the court. One of the most important features of the proposed law is the placing of every franchise within the State under the public service commission and so altering or amending any franchise as to make it in effect an indeterminate one. All franchises are, of course, granted by local authorities, but should the measure become effective none can be hereafter granted for any definite length of time.

Public Service Commission News

New Jersey Commission

The Board of Public Utility Commissioners has dismissed the complaint filed by Gately & Hurley, Camden, against the rates charged by the Delaware & Atlantic Telegraph & Telephone Company, holding that such were not excessive nor productive of more than moderate revenue on investment. In its decision the board states: "A return of 8 per cent on the fair present value of the company's investment seems to us fairly equitable, when consideration of all conditions is had. The proper allowances for depreciation are still of necessity largely conjectural. An 8 per cent annual return or profit on $5,338,000 (taken as fair present value of the company's investment) is $427,040. Earnings and expenses indicate that in 1908 the corporate deficit was augmented by $198,085.56, and in 1909 by $43,123.97; that the net earnings for 1910 were $160,756.32 and for 1911 $170,196.13. The net profits at present are clearly not excessive, but demonstrably moderate so far as this company is concerned. It follows that its rates as a whole cannot be assailed as unjust or unreasonable and that the petition so far as it alleges extortionate or undue rates should be dismissed." The decision affects Camden and the entire neighboring territory, including toll rates to Philadelphia.

New York Commissions

The Public Service Commission for the First District, by orders just served upon the companies, has established gas-pressure regulations for all companies furnishing gas for light, heat or power in the boroughs of Brooklyn and Queens, with the exception of the Thirty-first Ward of Brooklyn. This ward embraces Coney Island, where the consumption of gas is largest during the summer, and for this reason it is excepted from the order, but only until the commission can make observations of the conditions prevailing during the summer season, after which suitable regulations will be established for that ward. The orders in the main provide for the establishment of pressure gages and thereafter for the maintenance generally of a minimum pressure at the consumer's end of the company's service pipe of not less than 2 in. water column and for a maximum

pressure not exceeding 6 in. water column. Limitations are also placed upon momentary and pulsating pressure variations.

The Long Acre Electric Light & Power Company has filed with the commission an application for a certificate approving the construction of its plant. This company has been before the commission for several years in various applications for permission to issue stocks and bonds. These applications were taken to the courts and long litigation followed. In December, 1912, the Court of Appeals decided that the company had not obtained from the proper authorities consent to the construction of its plant. The present application is made to get the approval of the commission for that construction.

MARYLAND COMMISSION

The report of the Maryland Public Service Commission for the year ended Dec. 31, 1912, shows that the commission disposed during the past year of 442 cases and in 203 of these cases there were formal hearings. Reference is made in the report to the gas and electric rate case, which required forty-seven days for trial and the study of a great mass of testimony. The telephone case was also referred to and the steps in the fight were recounted. The Governor is advised that while the measured service is in effect under an agreement between the parties concerned, the question of measured versus flat-rate service is still open, and those contending for the latter will have until April to file data in support of their argument.

MASSACHUSETTS COMMISSION

The Massachusetts Gas and Electric Light Commission has issued a report upon the proposed codification of laws relating to electric and gas companies, including the question of extending the board's regulatory powers to so-called electric transmission organizations and the consideration of changes in the laws now bearing upon the gas and electric service industries and the need of additional legislation. A majority of the board favors the extension of its regulatory powers to so-called "power companies," covering such corporations as are primarily engaged in the manufacture, transmission and in some cases the distribution of electricity on a wholesale basis, as distinguished from the ordinary central-station organizations now under the jurisdiction of the commission. In the hearings it was urged that on account of the value which has attached to the right to subscribe to additional stock at the prices fixed in several instances by the most prosperous companies the board should have a more complete control over the issue price and that increases in stock should be offered to savings banks for investment in preference to the stockholders. The commission states that under the present method of fixing the issue price there may be a conflict between the personal interest of the directors or stockholders and the interest of the corporation in having its needed funds provided on as favorable terms as the market and other conditions will warrant. The board believes that the present method has not yet been shown to work such disadvantage to the public as to require a change.

The commission was asked to seek authority to make physical valuations of the properties under its supervision, but considers that the existing law provides amply for this. The commission feels that no public advantage would be obtained to justify the cost of making such physical valuations of all the properties under its supervision.

Regarding consolidations, the commission recommends that the combination of a gas or electric company with a transmission company or the organization of a combined gas and electric company should receive the approval of the board before becoming valid. It believes that it is desirable to preserve such measure of competition as may continue to exist by the independent operation and ownership of local distributing companies and so-called "power companies." The necessity for giving power companies the right of eminent domain has not yet become apparent.

In the case of discriminating rates, the commission does not deem it wise in the present development of the business of supplying gas and electricity to interfere actively with differential rates which are fixed solely to meet conditions competitive in their character and to that extent beyond the company's control, provided that the companies are thereby aided to give the community as a whole lower rates and better service. Restriction of security issues to actual needs and such control over rates and service as conditions require are advised.

The commission reviews at length the rise of transmission companies in the State, with particular reference to the hydroelectric systems of the Connecticut and Deerfield Valleys, and in an extended discussion shows that these are in large measure public-service corporations selling electricity for various uses and in some instances in territory already occupied by local central stations. It points out that the distinctions between power and central-station companies are to a large degree artificial, and considers that the extension of regulatory powers to cover the former is in the public interest.

Current News and Notes

PEORIA SEEKS GREATER POWER TO TAX PUBLIC-UTILITY CORPORATIONS.—The City Council of Peoria, Ill., has adopted a resolution requesting the Illinois Legislature to give to the city of Peoria power to tax and license public-utility corporations doing business within its limits but which have been heretofore, to a considerable extent, outside of the scope of the municipal taxing power.

* * *

X-RAY SOLVES COLLAR-BUTTON MYSTERY.—The disappearance of collar buttons is a perpetual subject for masculine objurgation and one of the stock jokes of the era of civilization. Thanks to the X-ray, one of these elusive articles has recently been located in the lung of its pursuer after a hunt which began sixteen years ago and terminated in a Pittsfield (Mass.) hospital in connection with an obstinate case of bronchial disturbance. Missouri papers please copy.

* * *

BATTERY-OPERATED TRACTOR FOR SWITCHING CARS.—The Pennsylvania Railroad Company recently completed at its Altoona shops a 14-ton battery-operated tractor to be used for switching freight cars in the Hudson Street yards at Jersey City, N. J. The heavy body, measuring 22 ft. long by 8 ft. wide, is carried on four 5-ft. double wheels which span the standard-gage track so that the tire pads obtain their traction from the ground surface itself. The body is equipped with standard couplers enabling it to pull as well as to push cars. As the tractor is independent of both rails and any fixed source of energy supply, it can pass around occupied tracks and move from place to place.

* * *

MILWAUKEE CITIZENS MAY VOTE ON MUNICIPAL LIGHTING PROPOSITION.—It is probable that the citizens of Milwaukee may have a chance, for the third time, to vote on the proposal to establish a municipal electric-lighting plant in that city. The plan will undoubtedly be submitted to the voters at the judicial election in April. In 1900 the city lighting plant was approved by a vote of 15,644 to 1463; in 1910, when the project was again submitted to the referendum, the vote was 10,645 for and 6701 against the proposition. Now that the Railroad Commission of Wisconsin is well established in the regulation of public utilities in the State, Alderman William Greene, chairman of the lighting committee of the Milwaukee City Council, thinks that very likely the opinion of the citizens has changed.

Crude-Oil Prices Advance.—Pennsylvania crude oil has rapidly advanced in price of late, being quoted at $2.26 on Jan. 29 by the South Penn Oil Company, the highest price since 1895. Mercer Black, New Castle and Corning were quoted at $1.79, Cabell at $1.86, Somerset at $1.32 and Ragland at 70 cents. It is predicted that old-time activity will soon return in the oil fields of Pennsylvania, Ohio and West Virginia.

* * *

Charged Wire a Burglar Trap.—While groping about in the dark in a small fruit store in Hoboken, N. J., Jan. 25, a midnight burglar came into contact with a charged wire and received a fatal shock. When the proprietor came to open the store for business next morning he discovered the dead body of the thief, his pockets stuffed with cigarettes, candies and fruit, and his hand badly burned, indicating the manner of his end.

* * *

Health Board for 200,000 Telephone Employees.—A system of medical supervision and sanitary instruction to preserve the health of the 200,000 employees of the American Telephone & Telegraph Company, the Western Union Telegraph Company and the Western Electric Company is announced by President T. N. Vail, of the first-named company. The new department will be under the direction of Dr. Alvah H. Doty, formerly health officer of the Port of New York, and will supervise hospital and first-aid provisions in the various plants of the allied interests, besides taking up preventive measures for the protection of employees' health.

* * *

Maine Utility Commission Bill.—State Senator I. G. Hersey, of Houlton, Aroostook County, Maine, has presented a bill before the Maine Legislature to establish a utility commission formulated on the plan of the Rhode Island act. The commission proposed would comprise three members, appointed by the Governor, who could also remove his appointees at pleasure. Obstruction to corporation investigations by agents of the commission is made punishable by a fine of from $200 to $500. Control of all franchises granted to public utilities by towns or cities is placed under the commission's control, and corporations can appeal to the commission from orders of municipalities.

* * *

To Determine "Wireless" Reach of New Washington Station.—The fast scout cruiser *Salem* has been ordered on a voyage across the Atlantic to test the transmitting capacity of the United States government's new wireless-telegraph station at Fort Myer, near Washington, D. C. This station was described on page 145, *Electrical World*, Jan. 18. Continuous tests are to be made throughout a radius up to 4000 miles, although it is expected that even this range will be exceeded. Eventually it is hoped that the powerful new station will be able to communicate with any ship of the United States Navy, using intermediate vessels as relays for distances above 3000 miles.

* * *

Carolina Bill to Tax Water-Powers.—A bill now before the South Carolina Legislature provides for the taxation of the developed water-powers of the State, at the rate of 20 cents per hp-year, if the energy is utilized locally, and 30 cents per hp-year for hydroelectric power transmitted or sold outside the State. It is further provided that the Governor shall appoint an electrical engineer at a salary of $3,000 per year, to be known as the commissioner of natural resources, whose duties shall include inspection of water-power plants and auditing of reports filed by the companies, collection of water-power taxes, investigation of service complaints against water-power companies, etc.

* * *

University of Illinois Electrical Show.—On Feb. 6, 7 and 8, 1913, in the electrical laboratory, the students of the department of electrical engineering of the University of Illinois will hold their triennial electrical show. Although under student management, it will be by no means wholly a student show, as many manufacturing and sales companies in the electrical trade will offer exhibits. Among the exhibits will be isolated lighting plants, heating and cooking accessories, telephones, telegraph and wireless apparatus, lifting magnets, motor controllers, high-frequency machinery and a complete electrically operated café. A business organization composed of graduates and undergraduate students is carrying on the entire work incident to the show, under the general direction of Dr. E. J. Berg, head of the department of electrical engineering.

* * *

SOCIETY MEETINGS.

Ohio Electric Convention.—The nineteenth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, on July 15, 16, 17 and 18. Mr. D. L. Gaskill, Greenville, Ohio, is the secretary of the association.

* * *

Prime Movers Committee in Session.—A meeting of the committee of the National Electric Light Association on prime movers was held in Chicago on Jan. 22. The members present were Messrs. I. E. Moultrop, Boston, chairman; W. L. Abbott, Chicago; E. D. Dreyfus, Pittsburgh; John Hunter, St. Louis, and W. N. Ryerson, Duluth. The forthcoming report to be presented at the Chicago convention was discussed.

* * *

Meeting of the Eastern New York Section of the N. E. L. A.—Mr. E. M. Bassett, former member of the Public Service Commission from the First District, New York, was the speaker at the meeting of the Eastern New York Section, N. E. L. A., at Schenectady, on Jan. 23. Mr. Bassett's topic was "Public Utilities Here and Abroad," and his address dealt largely with the municipally owned plants in this country as compared with the municipal plants of other nations. The paper proved very interesting and was discussed by Messrs. M. O. Troy, W. L. R. Emmet, C. W. Stone, H. W. Peck and A. Anderson.

* * *

Transmission Committee of Ohio Association.—The electrical transmission committee of the Ohio Electric Light Association, consisting of Messrs. M. H. Wagner, of the Dayton Power & Light Company, chairman; S. M. Rust, superintendent of the Greenville Light & Power Company, and P. Barnhard, manager of the County Electric Company, met at the Beckel House, Dayton, Jan. 22, to formulate its report for the 1913 convention, which will be held at Cedar Point, July 15, 16, 17 and 18. Messrs. O. H. Hutchings, superintendent, and O. B. Reemelin, chief inspector, of the Dayton Power & Light Company, joined in the discussion. A second committee meeting will be held at Columbus April 23.

* * *

Illinois Electrical Contractors.—At the recent midwinter convention of the Illinois Electrical Contractors' Association, held in Peoria, a resolution was adopted, at the request of Mr. Ernest Freeman, president of the National Electrical Contractors' Association, placing the Decker system of bookkeeping for electrical contractors at the disposal of the national association. A committee of mediation and arbitration, consisting of Messrs. C. E. Stapp, of Peoria; J. T. Marron, of Rock Island, and A. M. Knauber, of Chicago, was appointed to visit any locality in the State where disputes may arise between members of the association. A vote of thanks was extended to the Peoria association for its arrangements for the convention in Chicago in June.

Electrically Equipped Coal Mines in Nova Scotia

Application of exhaust steam turbine and pulverized fuel in the stations of the Dominion Coal Company—Operation on 25-cycle current. By C. H. Wright

THE coal deposits of Cape Breton were known to the early navigators who frequented the waters in the neighborhood of the mouth of the St. Lawrence River, and many a ship was coaled in a primitive fashion from the outcroppings of soft coal near the various harbors not far distant from the Sydneys. The present workings of the coal areas extend far inland and out under the Atlantic to a distance which can only be estimated, as they go beyond the limits of mechanical haulage. These Sydney coal fields, as they are called, have at present a known area of 250 sq. miles, extending some 35 miles from Mira Bay to Cape Dauphin. The major portion of this field is the property of the Dominion Coal Company, which is at present operating sixteen collieries, with a yearly output of 4,500,000 tons of coal, and is employing about 9000 people.

The installation of electrical equipment in the mines and power houses of this company began in the year 1906, when Colliery No. 2 (Fig. 1), near the town of Glace Bay, was equipped with a generating plant which contained three Westinghouse revolving-field alternators. These machines were rated at 550 kw, 6600 volts, 25 cycles, three-phase, and were directly connected to 700-hp compound reciprocating engines operating at 125 r.p.m. These units are shown in the foreground of Fig. 1. As the machinery in this mine was in a large measure air-driven, a number of air compressors were also installed which gave a total output of approximately 16,000 cu. ft. of air per minute at 100-lb. gage.

At the outset 25 cycles was chosen as the correct frequency to be used largely on account of the low speeds and small motor dimensions required, and 6600 volts was thought to be sufficiently high to give satisfactory transmission over the territory then covered. The distributing circuits were all overhead lines and were carried on a cedar pole line. To provide in part for future extensions, all line insulators were designed for 25,000 volts on these circuits. Later, in 1910, when the plant growth called for an additional power unit, a low-pressure steam turbine of the English Ratteau type, directly connected to a 1000-kw, 6600-volt Brown-Boveri generator operating at 1500 r.p.m., was installed. This turbine utilized only part of the exhaust steam coming from the engines which were driving the air compressors and operated condensing. The condenser for this equipment was of the barometric type with electrically driven auxiliaries. The fresh water for cooling was obtained from a nearby pond. An exciter mounted on the main shaft supplied the necessary energy to the generator field coils. This unit is shown in Fig. 6.

Lake Waterford Power House

The opening of the new areas near the Lingan collieries resulted in shifting the load center and necessitated the erection of a new modern power house at Lake Waterford to handle the load in that district and to operate in parallel with the station at Glace Bay. Special precaution had to be taken in providing for the operation of each plant separately since a part of the interconnecting line was built along the Atlantic seaboard at Lingan Bay and is sometimes in trouble because of storms and wave action. The Lingan power house is equipped with a battery of Beddington boilers, a type little known in this country, shown in Fig. 5. The fuel for these boilers is pulverized in grinders, mixed with air and fed under pressure at the bottom of the boilers. The vertical flame rises, then returns from the top encircling the boiler tubes and the superheaters. Although a very low grade of coal is used, excellent combustion is obtained. This equipment is quick steaming and meets the

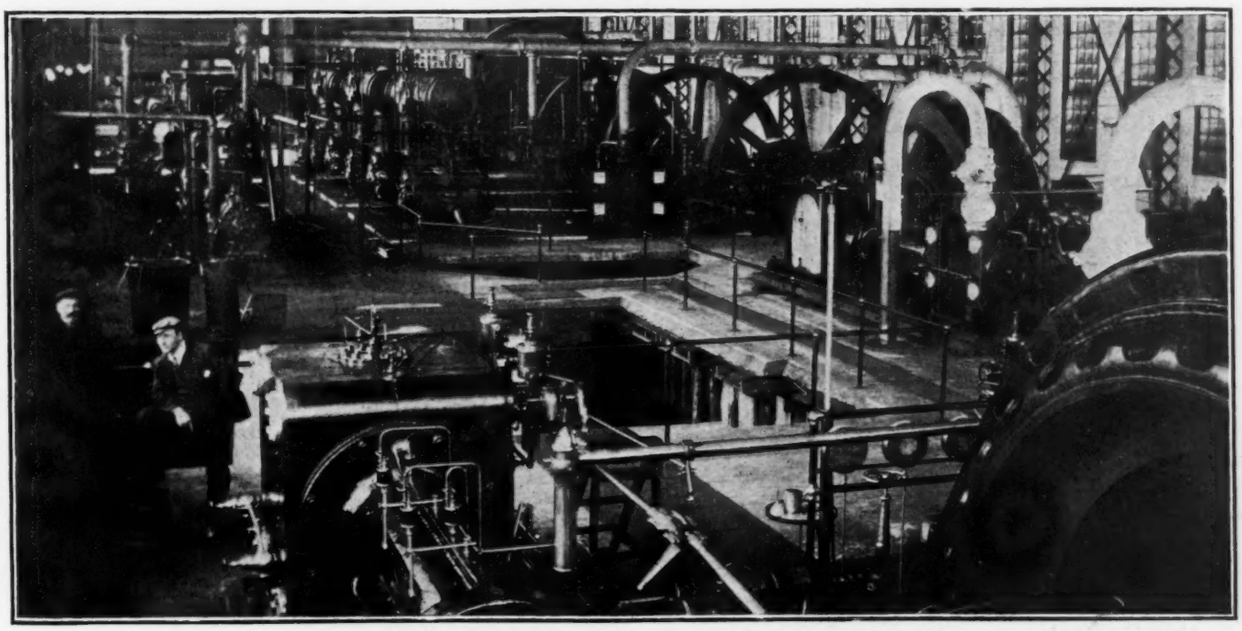


FIG. 1—POWER HOUSE AT COLLIERY NO. 2

peak loads so common in colliery work in a very admirable manner. These boilers are at present operating under a pressure of 175 lb. per square inch and are delivering steam at 150 deg. super-temperature.

The first turbine for this plant is now installed and in operation. It is a General Electric 2000-kw, 6600-volt, 25-cycle, three-phase horizontal high-pressure-type machine

FIG. 2—DOMINION COAL COMPANY'S PIER

taking steam from the boilers mentioned above and exhausting into a barometric condenser giving a 28-in. vacuum. A second unit is now being installed, and it is thought that a third will be required to operate the additional motors which the company contemplates installing. The switchboard, of modern European design, using remotely controlled oil switches, is being installed with the idea of future additions. The situation of the power house near

FIG. 3—BANKHEAD AND POWER HOUSE COLLIERY NO. 2

the mine entrance and near the lake has made fuel and water problems comparatively simple.

A typical transformer station for supplying energy to motor-driven pumps, belt conveyors, fans and similar apparatus usually contains three delta-connected, 75-kw, 6600-550-volt transformers, together with the necessary control apparatus, disconnecting switches, etc. All parts are so arranged that any of them may be easily reached in case repairs are necessary. The leads from these transformer stations to the underground pumping motors are taken down through 6-in. conduit placed in bore holes, and are generally of No. 4-0 copper, insulated with paper and protected by a lead sheath. The motors which serve these pumps are usually rated at 100 hp, 550 volts, and operate

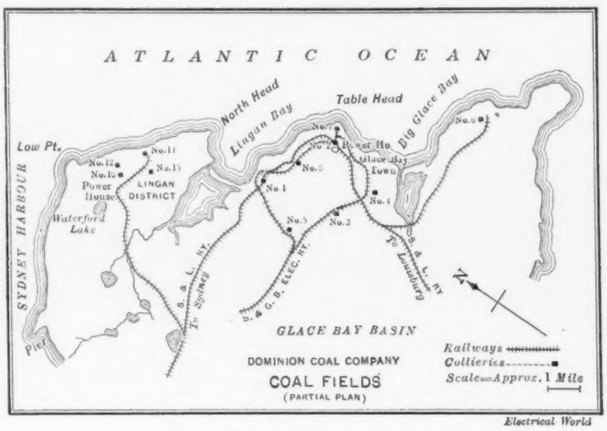


FIG. 4—MAP OF COAL FIELD REGION

at 1500 r.p.m. The pumps are capable of operating against a 600-ft. head.

Since so many of the motors in the system are operating on light loads during a large portion of the day, the power-factor of the plant would fall if means were not taken to correct it. This correction is accomplished by field adjustment on the 600-hp, 6600-volt synchronous motors which drive the air compressors. The motors have been specially

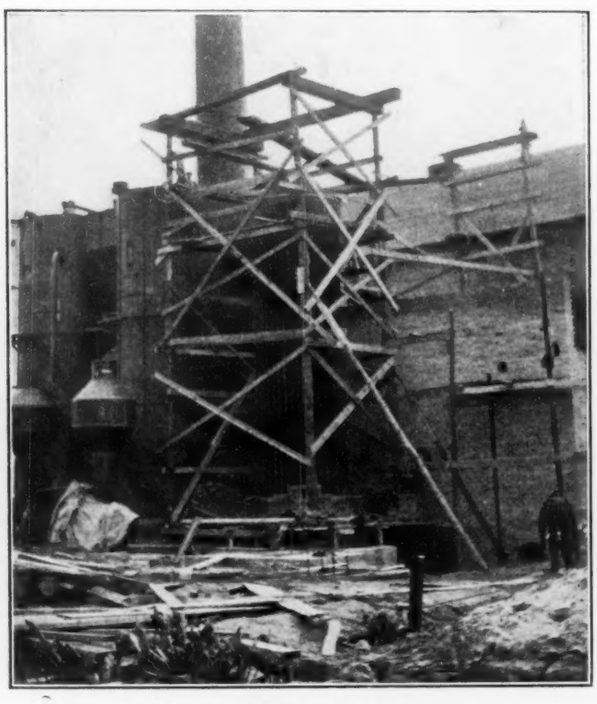


FIG. 5—BEDDINGTON BOILERS

designed for this work and are arranged to avoid hunting and to give an 80 per cent power-factor with leading current. They are started as induction motors from auto-transformers, with high voltage oil switches having a large overload capacity. All of these motors operate at full line voltage without transformers.

The economy of electrical energy over steam probably

shows most plainly in the coal hoists. Here the central station with its high steam pressure and good vacuum takes the place of the small, inefficient steam hoisting engines and does their work in a very creditable manner. The company's first large electrical coal hoist was located at Colliery No. 14, near the Waterford power house, and the constant output handled by that hoist is 1200 tons in every ten-hour day. The haul is made on a 22.5 percentage grade which is 4500 ft. long. The total gross weight of thirty cars per trip is 82,500 lb. For this work use is made of a direct-current motor mounted on the winding drum shaft and supplied with energy from a motor-generator set (Fig. 7) which takes its energy from the 6600-volt alternating-current mains. This motor has an intermittent load rating of 1600 hp and operates normally at 50 r.p.m.

In the near future two more electrical coal hoists of the same character will be installed near the Waterford station, and will haul twenty-four cars up a 32 per cent grade at a maximum speed of 30 ft. per second. The gross weight per car will be 2900 lb. and the length of the slope between 3000 ft. and 5000 ft., with an output of 1200 tons in eight hours. In order to diminish the load at starting the cars in this mine will not be started on the grade but from a level stretch of track laid at the working face of the mine for this purpose.

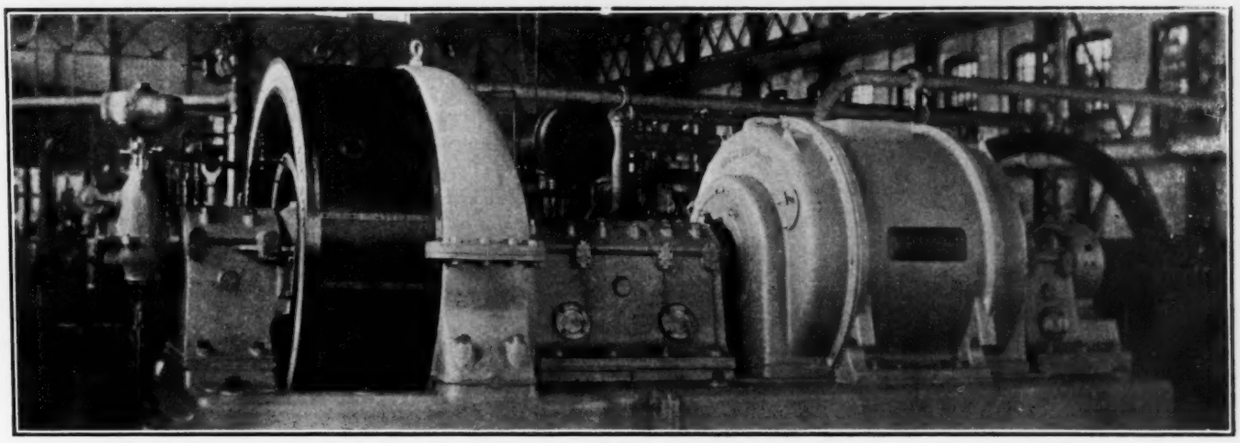


FIG. 6—TURBO-GENERATOR SET

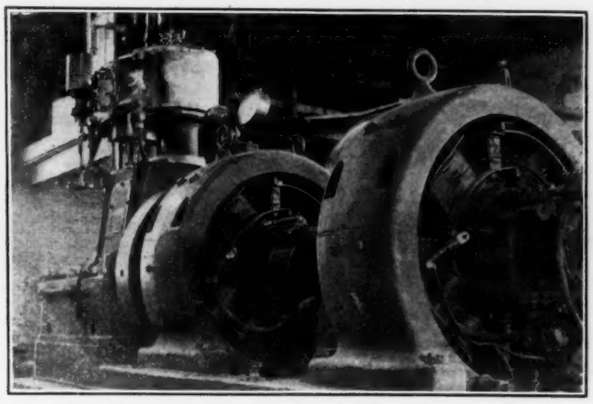


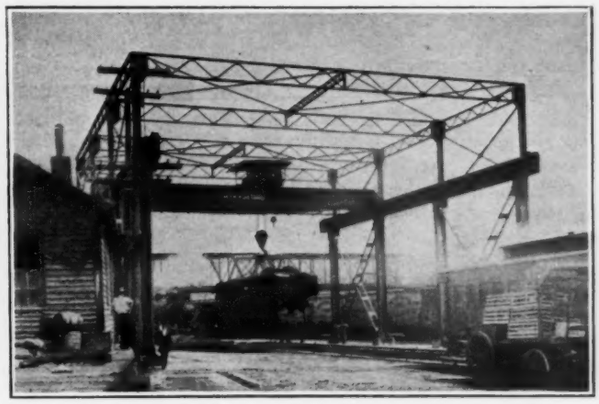
FIG. 7—MOTOR-GENERATOR SET AT COLLIERY NO. 14

At present the Dominion Coal Company has five large collieries in which all operations are performed by electricity with the exception of the heating, which is done by steam. In the older collieries nearly all of the screen pumps and fans are motor-driven, and a number of the underground haulage systems are operated by large motors on the surface.

Electric Freight Handling at the South Station in Boston

A noteworthy feature of the freight-handling facilities at the Kneeland Street terminal yard of the Boston & Albany Railroad at Boston, Mass., is a 40-ton Niles electric traveling crane located near the South Station and serving trains, trucks and teams in both loading and unloading service. The crane is operated by three-phase energy supplied by the Edison Electric Illuminating Company of Boston and is carried on 60-lb. T-rails placed 26.5 ft. above the ground and supported on a steel framework as shown in the accompanying photograph. The framework consists of eight columns 21 in. deep carrying two horizontal built-up I-beams 31 in. in depth, tied together at the top with cross-framing. Concrete foundations are used at the bottoms of the columns.

The crane spans two tracks and a paved roadway utilized by electric trucks, teams and other vehicles, the roadway being about 30 ft. wide. It has a span of 51 ft. 4 in., the length of the runway being 80 ft. and the maximum lift 25 ft. The crane is of the box girder type, the maximum depth of the principal members being 44 in. It runs upon four 24-in. wheels, the wheel base being about 13 ft. 4 in., each wheel carrying a maximum load of 55,000 lb. Besides the main hoist an auxiliary hoist of 5 tons rating is in service, and the former has a speed of 15 ft. per minute, the auxiliary running 30 ft. per minute. The main hoist is driven by a 75-hp, 440-volt induction motor running at 545 r.p.m., and the auxiliary hoist is operated by a 22-hp motor running at 650 r.p.m. The bridge travel, effected by a 37-hp motor running at 1115 r.p.m., is 250 ft. per minute



ELECTRIC FREIGHT HANDLING AT BOSTON TERMINAL

under full-load conditions, and the trolley travel, handled by a 15-hp motor running at 780 r.p.m., is 100 ft. per minute. All the motors are equipped with controllers permitting 25 per cent regulation of speed.

Energy from the system of the Edison Electric Illuminating Company of Boston is brought to the installation at 2300 volts by an overhead line terminating on a pole as shown in the photograph, the emf being reduced to 440 volts by a 100-kw oil-cooled transformer of the three-phase type mounted on a wooden platform about 14.5 ft. above the ground. An oil switch is provided on the primary side of the transformer, and the secondary leads are carried to a meter located in an adjacent wharf house, from which a pipe conduit leads to the craneway. Two switches are provided in the 440-volt circuit, one being located in the wharf house and the other on one of the crane columns to provide ample protection against accident. The transformer is installed upon 2-in. planking laid on 6-in. by 10-in. stringers carried on blocks which are fastened together by 5/8-in. bolts extending through the pole, and the stringers are also bolted to the pole structure in each case. The crane contacts are made in the usual manner from horizontal copper leads carried along the runway. The crane is located near the most important passenger tracks entering and leaving the South Station and illustrates to many thousands of travelers daily the advantages of central-station service in terminal hoisting work.

Electricity in the United States Army and Coast Defence

Brigadier General E. M. Weaver, chief of the Coast Artillery Corps, U. S. A., had much to say in his annual report this year which will be of general interest to the electrical industry. His report, which is made to the chief of staff, has been approved by Major General Leonard Wood, by direction of the Secretary of War. General Weaver said, in part:

Power Plants

It is estimated that it will require $4,450,333 to complete the electrical installations for coast forts in the United States. The estimates for the fiscal year 1914 will include $50,000 under this heading, this amount being required chiefly to provide for the replacement of certain worn-out local power plants now in use.

From past appropriations central power plants of a modern oil-burning type have been installed at Forts Winfield Scott, Stevens and Casey. Forts Baker and Barry have central plants made up of groups of 25-kw gasoline sets. Apart from these central-plant installations, fifteen independent local 25-kw gasoline sets were purchased from the appropriation for the year 1909 and were installed as follows: One each at Forts Rodman, Michie, Whitman, Foster, du Pont, Armistead, Moultrie, Dade and Canby, and three each at Forts Terry and Taylor. Eight of the same type sets were purchased from the appropriation for 1910, and these have been installed as follows: One each at Forts Williams, Andrews, Standish, Banks, Totten and Canby, and two at Fort Hamilton.

After a careful consideration of the conditions existing at the date of its report, the National Coast Defense Board recommended as follows:

"1. That the electrical power for fortification and defense purposes be furnished by an adequate steam-driven, direct-current-producing central power plant, all machinery to conform in type to approved commercial standards.

"2. That each battery or group of batteries, depending upon local conditions, be equipped with direct-current generators, gas or oil-engine driven, installed as a reserve to the central plant.

"3. That searchlights, except such as are in close proximity to the central plant, be provided with and operated by self-contained units."

Notwithstanding the fact that the National Coast Defense Board recommended the central-plant system as the fundamental one to be considered, it had in mind the dangers that might come to the whole defensive system from injury to that system, and therefore supplemented this recommendation by the further recommendation that each battery or group of batteries, depending upon local conditions, be supplied with an independent local reserve generating set, as indicated in the second paragraph quoted above.

At the date of the report of the National Coast Defense Board the steam-driven central plant afforded the most reliable and satisfactory method of producing power for fortification purposes, especially where the fortification plant was required also to provide light and power for post purposes. Since that time, however, the rapid extension and development of commercial power transmission lines have greatly simplified the question of the economical provision of power for post lighting and power purposes, in many cases eliminating the necessity for a central plant altogether. The development of oil and gasoline engines has at the same time progressed to a remarkable degree, so that, having in mind the special conditions which obtain at coast fortifications, including the danger to the fortifications resulting from interruption of power from a central source, and having in mind also the varying and infrequent loads required of generators for coast fortifications, the real advantage is considered to lie decidedly with the separate local plants. Following this line of analysis, a 25-kw direct-connected gasoline engine set has been developed especially to meet the needs of coast fortifications, which has in general proved very satisfactory. Approximately 160 of these sets have been installed for both power and searchlight purposes in the national fortifications.

For the foregoing reasons it is believed that the necessity for central-fortification plants, as recommended by the National Coast Defense Board, no longer exists, except in some special cases—for example, where power from outside commercial sources cannot be obtained. It is believed that in future the adopted policy should be:

1. To provide all batteries requiring power for fortification purposes (or, in certain cases, groups of batteries), and in general all searchlights, with suitable local direct-connected direct-current generating sets, preferably driven by oil or gasoline engines, these local plants to be so interconnected and provided with suitable reserve sets as to insure continuity and flexibility in service.

2. In general, in time of peace, to purchase the power for the post lighting system and for other similar post purposes, when it is in the interest of economy to do so, from commercial sources, and in such case to separate the post lighting system from the fortification system.

3. To install a central plant in case it is impracticable advantageously to purchase power for the post service, and in case the fortification system is insufficient for that purpose, such plant to constitute a reserve for fortification purposes.

4. To employ direct current for the post service systems in all cases except where transmission conditions are such as to render the use of direct current decidedly uneconomical.

5. The quartermaster corps to install a suitable reserve plant, in case the fortification system does not provide such a reserve, in all cases where power is purchased from a commercial source, the object of this arrangement being to provide for the actual necessities of the post in time of hostilities in case the source of commercial power be interrupted.

6. In general to provide, whenever practicable and advantageous, for interchangeability between the post and fortification power systems, including the introduction of

suitable converters whenever these may become necessary.

7. All power plants to be operated under the supervision of the coast artillery authorities, employing, whenever practicable, coast artillery enlisted personnel for that purpose, the object of this being to insure co-ordination and to prevent a division of responsibility in case of emergency.

It is believed that the sytsem above outlined will provide for maximum reliability for fortification power in time of war and for maximum economy in time of peace.

It is estimated that it will require $2,536,600 to complete the search-light equipment for the United States forts. The estimates recommended for the fiscal year 1914 will include $250,000 under this item, to be expended in the artillery districts of southern New York and Boston. It is expected that this sum will complete so much of the search-light installation in these districts as is practicable in time of peace. Twenty-three 60-in. lights are required. Fourteen have been purchased. Of these four have been installed tentatively.

These districts are provided with complete modern armament and the most modern fire-control installations. It is essential that the armament and fire-control equipment shall be supplemented by a permanent searchlight equipment if the fortifications are to be effective in night action. It should be kept in mind that searchlights of the power necessary for coast-defense purposes cannot be obtained in open market on the outbreak of war or when war is imminent. They are a special article of manufacture and require normally approximately one year to supply. The mirrors cannot be obtained in the United States.

Submarine Mines

Recent war has demonstrated the value of submarine mines as an element of harbor defense. If a harbor be defended by an efficient system of mines provided with the requisite guns and searchlights for their protection against countermining, sweeping or other methods of removing them, it is not believed that any enemy, however enterprising, will ever attempt to force an entrance into a harbor with large ships. It is a matter of satisfaction that severe tests have proved the American system of mines to be exceptionally efficient as a war weapon. The necessity for completing at once the submarine mine equipment has been frequently urged in past reports. In the annual report of the chief of coast artillery for 1910 it was stated that "We cannot afford to wait for war before completing our mine defense, but must be prepared beforehand; for unless we are thus prepared no amount of money made available at the outbreak of war could procure mine material in time to be of service in mine defense against an active, enterprising enemy. Essential parts of this material, such as cables, mine cases and electrical apparatus, cannot be bought in open market but must be manufactured to order, and after having been ordered it requires months to fill the orders. If confronted suddenly by war, only such material as is on hand can be utilized for immediate mine defense, and if any essential part of the mine system is lacking, the whole mine defense must fail. The complete mine equipment of every harbor to be mined should be kept on hand ready to be planted, and it should be made possible to mine effectively every harbor within forty-eight hours."

With the exception of the cable, the supply of the essential parts referred to above has been practically completed for all of the existing home ports except for the artillery districts of Galveston and New London. The need of making immediate provisions for the additional cable absolutely required to enable the mines, which are already provided, and for which all the principal accessories are also provided, to be planted at all home ports in case of emergency, is an urgent one.

The powerful and costly coast guns, mortars and mines provided for the defense of the coast cannot be operated to the fullest measure of their effectiveness except in connection with certain other costly, complex and scientific equipment installed for the coast fortifications, accessory to the service of the guns, mortars and mines. This accessory equipment includes range and position finders, plotting boards, range and deflection computers, telephones, steam and gas engines, electric generators for developing power for moving ammunition, traversing carriages, elevating guns and mortars; lights, both illuminating and searching; signals, including visual, telephonic and wireless; devices for loading and planting mines, and elaborate mechanical and electrical apparatus connected with operating submarine mines. A coast fortification should have all of this equipment provided and installed therein before its manning body is assigned to duty. The effectiveness of the fortifications with all this equipment, regarded as a unit, depends at all times upon the consideration that the armament and accessories must be maintained constantly in a condition of thorough serviceability. It will be understood that this can be done only by a highly trained and specialized body of officers and men.

Training the Men

The War Department, having in mind the principles set forth as to the necessity of having officers and men of the coast artillery personnel specially trained to maintain and operate the steam, mechanical and electrical engineering features of coast fortifications in a condition of highest serviceability, some years back provided courses of instruction for officers and enlisted men at the Coast Artillery School at Fort Monroe, Va., that had for their object precisely the training of selected officers and enlisted men for these technical duties. Accordingly there are among the commissioned personnel of the coast artillery officers who are designated as "artillery engineers," and among the enlisted personnel non-commissioned staff officers with the grades of "engineer," "fireman," "master electrician," "electrician sergeant" (first and second class) and "master gunner," whose duties relate particularly to the care, preservation and maintenance of the electrical and mechanical equipment of coast fortifications in condition of thorough serviceability.

Based on the estimates of the National Coast Defense Board, the percentages of completion of electrical installations necessary for full protection of home ports are as follows: Search-lamps, 41 per cent; power plants, 50 per cent, and submarine mines and structures, 81 per cent.

Power-Plant Operation

The power plant at Fort Monroe is operated entirely by enlisted men of the Coast Artillery Corps under the supervision of the head of this department of the school. It is used for instruction purposes by both the officers' and the enlisted men's divisions. The results obtained in the operation of this plant have been very satisfactory, an average daily power and lighting output of 1200 kw-hr. for the twelve months ended Feb. 29, 1912, having been produced at a cost per kilowatt-hour at the switchboard of 3.38 cents, including all supplies, repairs, labor and depreciation, or of 1.19 cents excluding labor and depreciation costs. It is estimated that the installation of this plant and its present use for post lighting, pumping, fortification, school and heating purposes has resulted in a decrease in the total annual maintenance cost of the school and post of Fort Monroe of approximately $25,000; or, making allowance for labor of all enlisted personnel involved and for depreciation cost of plant, in an annual net commercial saving of over $13,000. It is indicative of the high opinion held of this plant in commercial circles that some of the most prominent manufacturers of engineering apparatus in the United States have cited it as exemplifying in a noteworthy manner the efficiency that can be obtained with isolated plants of comparatively small capacity.

Performance Similarities of the Direct-Current Shunt Motor and the Polyphase Induction Motor

By William G. Merowitz

The average user of electric motors is unaware of the striking similarity between the performance curves of the direct-current shunt motor and the polyphase induction motor and is generally prepossessed with the idea that the work which either of the two machines can be made to do is widely different from the field of operation of the other. With the intention of pointing out more clearly the similarity in the output characteristics of these types, two machines were taken from the stock of a prominent New England manufacturer and subjected to performance tests over wide ranges of load. These two motors were of as nearly the same rating as it was possible to procure, each being a 7.5 hp, 220-volt machine. However, there was the slight difference that the direct-current shunt machine operated at 1000 r.p.m. and the three-phase squirrel-cage induction motor was designed for 60 cycles and operated at 1120 r.p.m. The results of a brake test on each of these machines are shown graphically in Figs. 1 and 2. In order that these results may be more easily compared, the three most important characteristics of the two machines have been plotted on the same sheet and are shown in Fig. 3. From this illustration it may readily be seen that the torque, watts input and efficiency for the two machines are nearly identical within the limits of practical operation. In regard to starting torque it may be said that the two machines perform equally well for commercial purposes, but the starting torque of the alternating-current machine may be materially increased by inserting additional resistance in the rotor circuit.

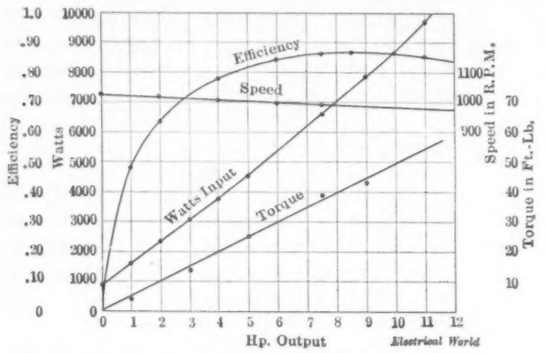


FIG. 1—PERFORMANCE CHARACTERISTICS OF A 7.5 HP, 220-VOLT DIRECT-CURRENT MOTOR

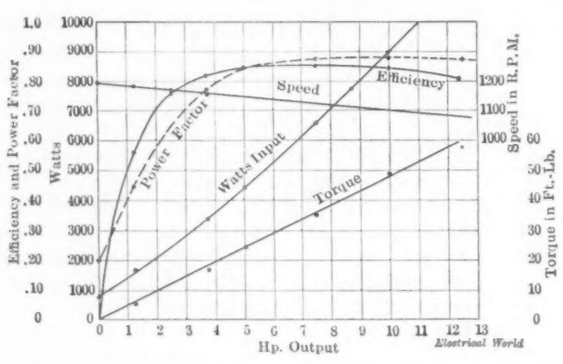


FIG. 2—PERFORMANCE CHARACTERISTICS OF A 7.5-HP, 220-VOLT, 60-CYCLE INDUCTION MOTOR

It has been observed that the losses at intermediate loads are less in the polyphase machine than they are in the direct-current motor, which in a large measure accounts for the slightly higher efficiency of the alternating-current machine on the lighter loads. On overloads the efficiency curve of the polyphase machine shows it to be less efficient than the direct-current motor, but as a matter of fact the alternating-current motor is better adapted to overload operation than is the direct-current machine, since the latter is subject to commutation troubles when operated above normal load.

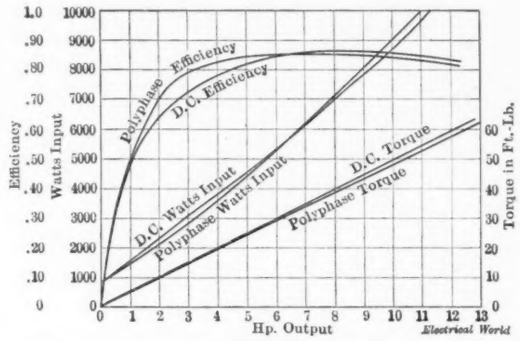


FIG. 3—COMPARATIVE PERFORMANCE CHARACTERISTICS OF DIRECT-CURRENT AND INDUCTION MOTORS

The curves marked "speed" in Figs. 1 and 2 show the speed regulation of the direct-current machine to be considerably better than that of the induction motor. Both of these types of motors are considered to be constant-speed machines, the direct-current motor on account of the constant value of field flux and the induction motor because of the constant value of line frequency. The poorer speed regulation of the induction motor manifested in these curves is not inherent in this type of machine but is due to a comparatively high resistance rotor used in this machine for the purpose of producing greater starting torque. It should be said in this connection that racing is never experienced with the polyphase motor, as it is impossible for the machine to run above synchronous speed. The direct-current machine, however, may in event of a weakened field reach speeds which are dangerous to the armature windings from the high centrifugal stresses.

To supplement the foregoing performance tests a large number of data were collected on the relative weights and costs of these two types of machines, and curves have been plotted to show these facts. From the graphic comparison of weights shown in Fig. 5 it may be seen that for a 7.5-hp output the weights of the machines are most nearly alike, and that above this point as the output increases the curves diverge. The rapid increase in weight per horse-power of the direct-current machine is due almost entirely to the commutator, which must be made large in order that it may remain within the specified limits of temperature rise. The weight per unit output for inclosed motors is higher than for the open machines shown in these curves.

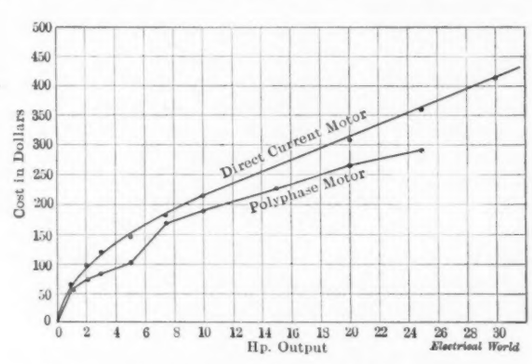


FIG. 4—COMPARATIVE COSTS OF THE TYPES OF MACHINES

The curves of Fig. 4 show that for the same output the polyphase motor is the cheaper machine. This result is to be expected, for the commutator is an expensive part of the direct-current motor, not on account of the cost of the copper alone, but because of the high cost of its construction. As is characteristic of the weight curves, the cost curves show that for increasing outputs the cost of

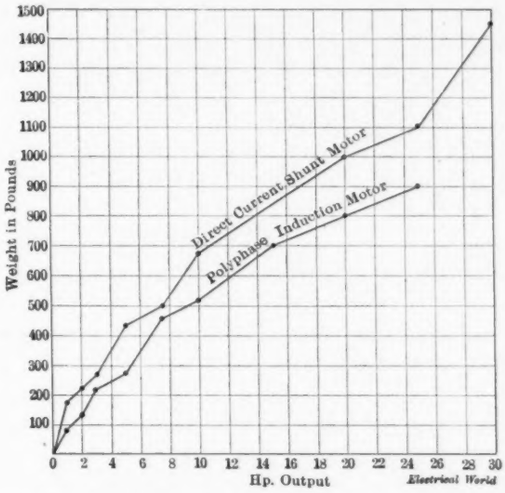


FIG. 5—COMPARATIVE WEIGHTS OF THE TWO TYPES OF MACHINES

direct-current machines increases more rapidly than does the cost of the polyphase machines. It rarely happens, however, that the prospective buyer concerns himself with the comparative costs of alternating-current and direct-current motors as he is compelled by existing circumstances to employ one or the other without choice. For this reason it is the writer's opinion that the competition between these two types of machines will never be of a very keen nature, even though it has been shown that the two machines are very well adapted to do the same work.

Electric Arc Used for Igniting Gas in Tunnel

In boring the municipal aqueduct tunnel through the Santa Ynez Mountain range in California for the water supply of the city of Santa Barbara, gas was encountered in large quantities. In order to guard against and safely dispose of this inflow a system of electric arcs was installed in the tunnel and used to ignite the gas after firing a round in the heading. The specially made arc lamps were placed in high points along the tunnel about 200 ft. apart, the first one being located about 150 ft. back of the heading. Thirty minutes after the blast was fired the arcs were switched into circuit and an ammeter at the switch indicated whether the lamps responded or not. After obtaining results of arcing from the portal the fire boss and helper would advance to another arcing station 3500 ft. from the portal, and electricity would be again applied. If no gas explosion ensued, the entire tunnel ahead was explored with safety lamps. If no pockets were discovered, the inspectors returned to the station, where the arcs were again switched into circuit, and with the arc lamps burning the inspectors returned to the heading and placed torches at intervals of 100 ft. through the gas section, which were kept burning during the next shift. Four hours were consumed in testing before the next heading crew were permitted to go on shift. Two heading shifts were maintained, and aside from the two four-hour periods of fire-boss shifts the work was uinterrupted. Water was also encountered in large quantities. The tunnel is 19,560 ft. long.

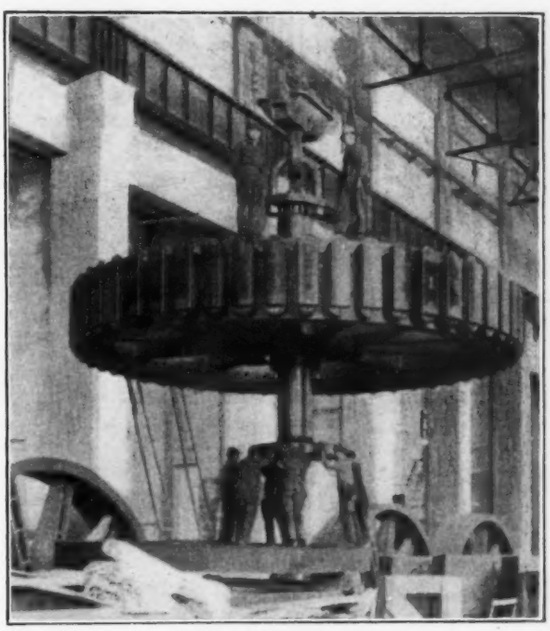
Progress of Keokuk Water-Power Development

During the three months covered by Progress Bulletin No. 8, issued under date of December, 1912, by the Mississippi River Power Company, which is building the 200,000-hp hydroelectric plant at Keokuk, Ia., work on the dam, power house and locks has gone forward rapidly.

The main dam was connected with the power house structure in October, and this has enabled carloads of machinery to be delivered directly to the plant without being rehandled. Three turbines have already been received and completely erected. The runners weigh 65 tons each and measure 16.5 ft. in diameter and 12 ft. in height. One manufacturer cast his runners in four quarters, to be fitted together at the site. The other built his wheels in a single piece, for the transportation of which a special 75-ton car was required. The car followed a route carefully selected with respect to bridge clearances and was allowed to travel only during daylight as a safeguard against accident. Eight days were consumed in making the trip from Akron, Ohio, to Keokuk.

Concrete for the ship lock is now complete, and the huge 300-ton gate leaves, each 50 ft. by 67 ft., are already in place. Construction of the sixteen draft tubes in the south or second half of the power house has been pushed rapidly during the fall and winter months. The north half of the structure, housing the first group of machines, is now practically completed and the building is rapidly assuming its final appearance. Even the concrete barriers and soapstone slabs for the 11,000-volt bus structure are partly in place. To date five of the generator stators have been wound, four rotors have been assembled, four bases are in place, and one has had its stator sections mounted in position.

Owing to a change in the plans, it has now been determined to extend the piers and arches of the dam around the north end of the power house and thence diagonally



INSTALLING ROTATING-FIELD MEMBER OF 7500-KW ALTERNATOR AT KEOKUK

downstream to a point on the Iowa shore near the north end of the seawall. Dam and extension will thus form a bridge for the passage of railroad trains, a steel drawbridge permitting boats to go through. About sixty spillway sections at the center of the main dam have been left open to permit the discharge of the river's flow, but will later be closed in succession with the aid of stop-logs and dikes.

A New Method of Timing Watt-Hour Meters

By Gordon Thompson

The percentage accuracy of watt-hour meters is experimentally determined by comparing the watt-hours or watt-seconds represented by a certain number of revolutions of the meter disk with the watt-hours or watt-seconds computed from the indications of power-measuring instruments and the speed of the meter. In precision work, such as the calibration of rotating standards and the testing of watt-hour meters under the Meter Code of the National Electric Light Association and the Association of Edison Illuminating Companies, it is necessary that this speed be determined with an accuracy of at least 0.1 per cent.

Up to the present the accurate measurement of time in watt-hour-meter testing has been generally accomplished by means of stop-watches. An approach to the degree of accuracy stated above has been sought by using the average of a number of determinations of a long period of time; for example, it is customary to take the average of six readings, each 100 seconds long, for a single test on a rotating standard.

The errors of the stop-watch are, however, large and variable. First, there is the error which is produced at the starting of the recording mechanism. The toothed wheel on whose shaft the second hand is mounted usually has 120 teeth, each tooth thus corresponding to one-fifth of a second. The even chances therefore are that the time of engagement of the gear train as indicated by the second hand will be one-fifth of a second ahead of, coincide with or be one-fifth of a second behind the actual moment that the impulse is given to the stem of the watch. In commercial testing the testers usually take readings only 40 seconds in length; in these cases there is a possible error of 0.5 per cent. Of course the probabilities are that this starting error will be reduced to a negligible quantity if the tester use the average of a number of readings of a long period of time. But the uncertainty is ever present.

A second starting error is found in watches not of the highest grade, caused by the impulse given to the light second hand by sudden and imperfect meshing with the moving gear train. This "throw" often amounts to one-half of a second and constitutes a serious source of error.

The remaining error found in the indication of a stop-watch is the time error of the watch's movement.

Finally, the stop-watch method is subject to the personal error of the observer; he may not correctly determine the time of transit of a mark on the meter disk past a fixed point which he has selected. It is reasonable to believe, however, that he will make the same error at the end of his determination as at the beginning.

Before passing from the stop-watch method, attention should be called to the corrective tendency of a comparison check of the stop-watch with a standard clock. If the number of readings made in this comparison is not small and the time period involved is long, the starting errors will be reduced to a minimum, the time error will be determined, and it is probable that the personal error of the observer will be evaluated. However, having in mind these errors, their probable values and the means of determining and eliminating them, it is not wise to place the probable accuracy of the stop-watch method above 0.2 per cent.

The large amount of "code" testing of watt-hour meters being done at the Electrical Testing Laboratories, New York City, has emphasized the need of a more accurate means of measuring time than the stop-watch. The first method tried consisted in the substitution of an ordinary chronograph such as is commonly used in physical and astronomical work. Simultaneous records were made on a chart by a standard clock beating seconds and by a key pressed by the observer at every revolution of the meter disk. This method gave an accurate measurement of time, but the observer's personal error remained. Obviously the next step was to make the meter record its speed automatically. Here the work done by Messrs. J. B. Seaman and Burleigh Currier was followed. In the method devised by them contact was made between two platinum-tipped wires or between a platinum wire and a mercury cup at every revolution of the meter. The times of contact were recorded on a specially designed chronograph with six pens which has been named an "errometer." This method of making the meter self-registering has been superseded in the testing at the Electrical Testing Laboratories because the contacts are not permanently reliable and a new method of fastening them to the meter must be devised for each new type tested.

The latest step is represented in the apparatus described below, which was devised by the writer and has been in use at the Electrical Testing Laboratories since Sept. 1, 1912. The scheme is to cause a high-voltage spark to pass from a stationary point to a point on the disk or other part of the meter's rotor at each revolution and by its passage to operate a relay which in turn produces a movement of the pen of a chronograph. The meter itself thus makes a reliable record of its speed without bringing anything into contact with its moving element.

The high voltage necessary for the spark is furnished by a small 10,000-volt testing transformer (T in the sketch), connected across a variable alternating-current supply. A limiting resistance R is placed in series with its primary, and the voltage applied to the circuit is varied by means of an auto-transformer A. One terminal of the high-tension or secondary winding of the transformer is connected to the meter register. The other terminal of the secondary winding ends in a well-insulated needle-point P. This is so placed that a moving point on the meter's rotor passes near it at each revolution. With rotating standards the large pointer of the recording mechanism constitutes the moving point, the stationary point being a piece of wire held beneath the glass cover near the dial. In the case of house-type watt-hour meters a piece of wire weighing about 10 milligrams and bent into a U-shape is sprung onto the edge of the meter disk to form the moving point S.

When the moving point comes opposite the needle-point a spark will pass. This practically short-circuits the transformer secondary, and the load current which flows will greatly increase the voltage across R. The electromagnet M of an alternating-current relay is shunted across R, and this increased voltage operates the relay. A copper rod attached to the armature is thereby caused to dip into a mercury cup L; this completes a local circuit through the electromagnet of a chronograph K, and a record of the passage of the spark is thus made. A standard clock C sends seconds signals, which are recorded on the chart by means of the same pen.

The insulation of the meter coils is never subjected to a higher potential than 120 volts, and the tester can receive a shock only by deliberately touching the high-tension needle-point, which is incased in a tube of high insulation.

A liquid contact used in the chronograph circuit gives a record of nearly constant length at all speeds of the meter disk. The moving element of the relay is large and heavy and is controlled by gravity; vibrations are damped out by means of a spring. The chronograph employed at the Electrical Testing Laboratories was made by Mr. William Gaertner, of Chicago, and has two pens mounted on a rolling carriage which is moved the length of a recording drum by means of a screw thread. The speed of the drum is maintained at a constant value by a centrifugal governor. When the chronograph is correctly adjusted the record drum makes one revolution in exactly thirty seconds. Since the diameter of the drum is 6 in., a one-second interval is represented on the record by two marks about $\frac{5}{8}$ in. apart. Fractions of a second are read with the aid of ten radial lines etched on a microscope cover-glass. Even 0.05 second may be read with the greatest ease.

The presence of two pens permits the simultaneous testing of two meters. Red and black inks are used.

The method of working up the chart is simple. A meter mark near the beginning of the record is selected as the zero revolution. The second mark immediately preceding the meter mark is taken as the zero of time. A line is then drawn through the second marks in the same vertical row. Since the marks on this line are thirty seconds apart, as explained before, the number of any particular second is easily determined. The meter revolutions are counted in the same way by means of inclined lines drawn through marks on adjacent rows. From the time of a given number of revolutions the speed of the disk is computed and then the meter accuracy is determined in the usual way.

The possible inherent errors of this method—that is, neglecting errors made in working up the charts and in holding a wrong load value, which are not peculiar to this method—are the following:

1. Variation of the spark.

2. Acceleration and deceleration of the rotor due to electrostatic attraction.

3. In alternating-current meters the current from the spark, traversing the disk, may produce a torque by reaction with the fluxes from the pole tips.

1. In successive revolutions the spark may not always jump the air-gap when the two points are in the same relative position. This variation has a maximum value of not more than 1/32 in. and is of frequent occurrence only at high speeds. In a disk 3.5 in. in diameter (modern small alternating-current meter) this variation would produce an error of about 0.3 per cent in one revolution. To reduce the possible error to 0.1 per cent it would therefore be necessary to take at least three revolutions in a test, assuming that only the first spark overleaps and all the others are normal, which, of course, is the extreme case.

2. There is always electrostatic attraction between two bodies maintained at a difference of potential. In this method, however, it is usually the case that we have only a point projecting 1/16 in. from a surface of comparatively large area; hence the electrostatic field between the fixed point and the meter disk is appreciably changed only for the short time that the moving point is sweeping past the needle-point. It is reasonable to assume, therefore, that any acceleration due to electrostatic attraction with the approaching point will be entirely counterbalanced by the deceleration with the receding point. This matter has been investigated by carefully noting the speed of rotation of a rotating standard having a "creep" of one revolution in about twenty seconds. Here we have the pointer of the register constituting the moving point and the extreme case is set up of a great change in the field between the two electrified bodies for about one-tenth of a revolution. In this particular case, however, no change in speed whatever could be detected either before or during or after the passage of the spark.

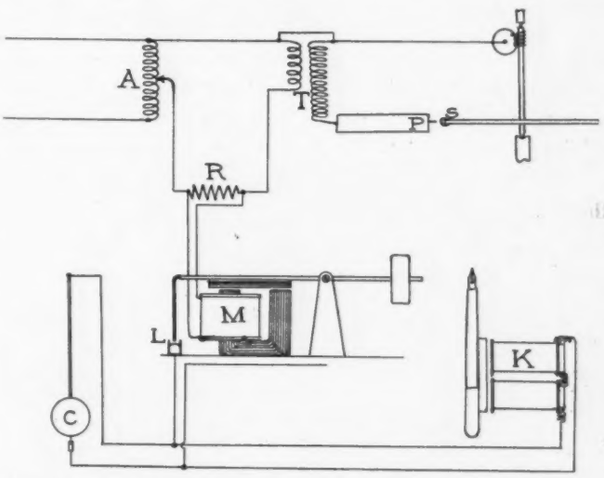
3. In certain types of alternating-current meters the electromagnetic windings are on the front side of the rotor shaft. In testing meters of this particular type it is conceivable that the "spark" current in traversing the disk below the pole pieces might exert a torque affecting the rotation of the moving element. This effect can be eliminated by using for the spark a current of another frequency than that on which the meter is operating. In the "code" testing done at the laboratories this method has been followed. Some tests have been made by them, however, in which the same source was used for both the meter and spark; that is, the same frequency was used for both. The results obtained showed negligible differences even at light loads from those obtained using two frequencies.

The third error is therefore apparently negligible and may always be eliminated by the use of different frequencies for the test and spark currents.

A large number of tests have been made in which the test meters were timed by this method, and the results obtained have in every case been perfectly uniform and consistent, as distinguished from previous tests where stop-watches were used and frequent rechecking was necessary.

A meter-test board is now being built having in view the application of this method of timing to all classes and types of watt-hour meters of the motor principle. The high-tension transformer is to be mounted above the test board beyond striking distance. The high-tension needle-point will be placed on an insulated carriage running on a metal track in front of the meters so that it can be placed in operation on any one of the meters in a few seconds. The needle-point will be connected to the transformer by means of a heavily insulated flexible cable. Only a few tenths of an inch of the needle-point will be exposed, so that the tester must deliberately reach his hand around and touch the point to get a shock. Even then the shock received will not be dangerous, since the secondary current is limited to about 0.008 amp. The chronograph is to be placed at the end of the table in a convenient position.

The advantages of this method of timing watt-hour meters with a view to obtaining a result accurate to 0.1 per cent are the following:



SPARK-GAP AND CHRONOGRAPH CIRCUITS FOR TIMING WATT-HOUR METERS

1. The method requires only one observer, whose sole duty is to maintain a constant load, as contrasted with the stop-watch method, where two observers are necessary.

2. The inherent errors are negligible and the final accuracy depends only on the precision with which the load is maintained. With the stop-watch method there are variable errors due to watches and to the observer.

3. The meter records its own speed in a permanent form on a chart which may be preserved indefinitely for future reference. This is of importance in "code" testing in particular. The stop-watch method has no means for the preservation of the tester's readings.

4. In "code" testing and in investigation work where a few meters are subjected to a large number of tests, a large saving in expense results from the shorter length of time required to perform the test. Moreover, many meters may be tested at one time and in a shorter length of time than is required by the stop-watch method. If a chronograph with two pens be used, the speeds of twenty watt-hour meters at one load may be easily obtained in twenty-five minutes. By the stop-watch method, using four testers, three of whom are timing meters, at least forty minutes would be required.

In short tests on single meters the expense represented by the time required to "work up" charts is offset by the saving in expense resulting from the use of only one observer.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Wiring Old Houses in Nashville

One of the important and ever-present problems of the central-station manager is devising means to bring about the wiring of old houses. In many of the older cities the proportion of residences wired for electric service is far too small. As the result of a recent energetic campaign Mr. James E. Carnes, contract agent of the Nashville (Tenn.) Railway & Light Company, reports that during a period of eight weeks 142 old houses have been wired for electricity. This is a good record for a city of the size of Nashville, and should be emulated in many places where there has been little or no recent old-house-wiring effort.

Discouraging the "Loan Shark" in St. Louis

Effective Feb. 1, a loan fund has been created by the Union Electric Light & Power Company of St. Louis. Deserving employees who may need money temporarily to meet emergencies such as arise from sickness, death in their families or other unforeseen contingencies may borrow from the company, without interest, subject to the provisions of the plan governing the loan fund. The maximum amount to be loaned to one employee must not exceed 50 per cent of his monthly salary. The amount of the instalment repayable each pay day shall represent at least 10 per cent of the loan. Application for a loan shall be made to the company by the employee through the chief of department, superintendent or foreman, and be approved by the head of the department in which the applicant is employed. The total amount of money outstanding on loans at one time shall not exceed $5,000.

Fifty Cents Increase in Monthly Rent Pays for Wiring Dwelling

By first getting tenants of unwired property to agree to an increase of from 50 cents to $1 in their monthly rent, provided that the modern convenience of electric wiring is installed, the commercial department of the Tri-City Railway & Light Company, of Davenport, Ia., has succeeded in obtaining house-wiring contracts from a number of local landlords who would not have been likely to authorize such construction if approached along the usual lines.

Such an increase of $6 to $12 per year in rental income easily covers the interest cost on the average outlay for wiring, besides leaving a comfortable surplus to retire the original expenditure in a few years, so that the property is soon left with a substantial improvement at practically no cost to the owner. Almost any tenant, of course, would willingly submit to an increase of from 50 cents to $1 a month for the convenience and comfort of living in a modern, wired dwelling, while for renting the same premises to the next tenant the appreciation in rental value may well be several times this amount.

The Davenport company's experience, like that of other central stations, had been that a simple request from the tenant was hardly sufficient to bring the landlord to spend the amount necessary to have the house wired. "But when the owner is presented with a written agreement on the part of the tenant to pay more rent it becomes a different matter," according to Mr. H. C. Blackwell, vice-president and general superintendent of the Davenport company, "and in this way we have succeeded in wiring houses which otherwise never would have been wired." The business department also keeps in close touch with local real-estate men, attending their meetings and taking up with them the matter of soliciting their tenants to adopt electric lighting and energy-consuming devices.

An Automatic Appliance Demonstration

The value of office displays in creating interest among customers was demonstrated in particular by the Ripon (Wis.) company which during a recent appliance campaign installed the automatic apparatus demonstration herewith illustrated. At one side of the office space Mr. W. E. Haseltine, local manager, set up the life-size pasteboard figure of a woman who, flatiron in hand, presided over an ironing board. Surrounding her were various motor-driven devices, such as electric washers, sewing machines, buffing and grinding motors, vacuum cleaners, fans, etc. Overhead numerous small Christmas-tree lamps were festooned, and, it being the holiday season, an electrically lighted tree blazed at one side. By means of a hand-made flasher in the basement, the different devices and lamps were alternately started and stopped, one after the other, giving a mysterious and striking effect. This exhibit attracted to the office many who would not otherwise have come, and each had some question to ask about some device or appliance so that much desirable publicity was created.

APPLIANCE DEMONSTRATION AT RIPON, WIS.

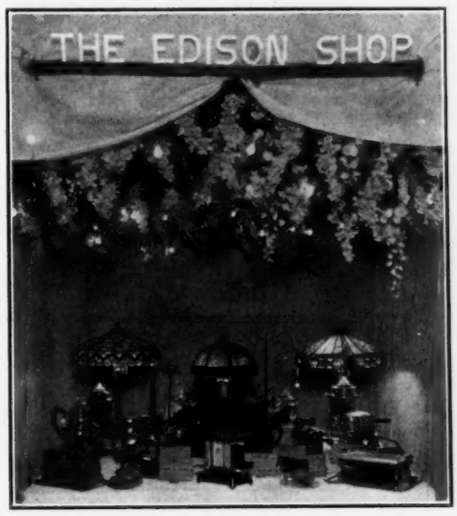
Commercial Growth at Louisville, Ky.

The Louisville Lighting Company, of Louisville, Ky., announces an increase of 100 per cent in the number of new customers it secured during December, 1912, as compared with December, 1911. December, 1911, in turn, had shown an increase of more than 100 per cent in the number of customers secured over the corresponding month of 1910. As the result of two years of strenuous business-seeking, the commercial department of the company is in a position to show more than 200 per cent increase, a record of which it may be justly proud. An increase of from 18 to 25 per cent in the station load of the company was also noted during December, 1912.

Giving Church-Fair Sales Profits to Charity

The question of the best way in which to contribute to the many local charitable movements, such as church bazars, hospital fairs, etc., for which the aid of central stations is solicited is one that has to be decided frequently by the management of these companies.

One way to help worthy causes and at the same time to secure desirable publicity is the general scheme followed



BOOTH AT A BROOKLYN CHURCH FAIR

by the Edison Electric Illuminating Company of Brooklyn. The exact plan varies somewhat with each case, depending on the urgency of the need, but the general idea is to purchase space for a booth at such functions, exhibit a full line of appliances and give some part of the proceeds, usually the profits, to the cause. This has been found to be more satisfactory and also more effective in placing the appliances in service than the customary plan of donating a smaller number of devices to be sold by the ladies in attendance. Regular demonstrators from the company's appliance department, the "Edison Shop," are in attendance. The accompanying illustration shows the company's exhibit at a recent church fair.

Central Station Offers Services of Lecturers

As already mentioned in an editorial comment in these columns, so many requests have been received by the Edison Electric Illuminating Company of Boston for lecturers to talk on electrical subjects before different local organizations that a series of lectures has been arranged for this winter, speakers to be furnished without charge by the central station's advertising department.

Lectures will be delivered before men's clubs, boards of trade, improvement societies, church societies, women's clubs, schools and colleges, Y. M. C. A.'s and lecture classes near by—in fact, before all representative organizations among the million people in the 600 sq. miles of territory served by the company. Manufacturers have been requested to furnish samples of appliances which it would be practicable to exhibit at lectures of this character. The committee on lectures also has in mind the preparation of moving-picture films which can be used in the smaller types of Edison machines. These are manufactured expressly for home use and can be used to excellent advantage in any ordinary hall.

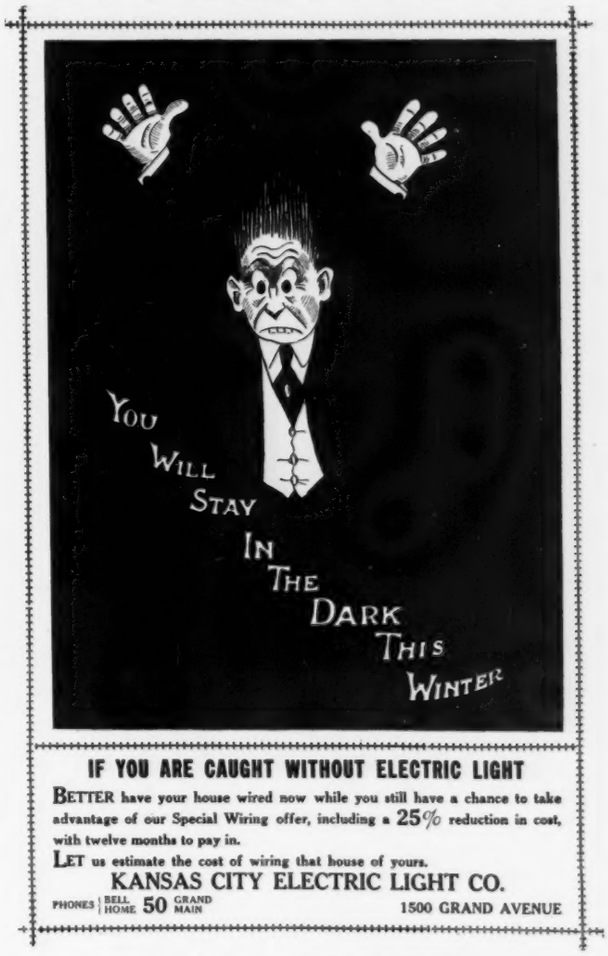
Requests for dates have been coming in rapidly since the announcement. Addresses were made in November at the Men's Club, Christ Church, Hyde Park, and at the Men's Club, Episcopal Church, Watertown, by Mr. L. D. Gibbs, and at the Phillips Brooks Club, St. Mary's Episcopal Church, and Tremont Street Methodist Episcopal Church, by Mr. La Rue Vredenburgh. During December Mr. Gibbs lectured at Watertown and Mr. Vredenburgh at Roxbury.

Window Display Operated by Motor-Driven Blower

An ingenious moving display with something of mystery about it has been attracting attention in a window of the Kentucky Electric Company, of Louisville. A barely perceptible slit was cut in the floor of a small dais erected in one of the Fourth Avenue windows, and beneath this slit was mounted the discharge of an air pump, the nozzle being carried on a traveler so as to traverse, back and forth, the length of the aperture. Mounted on the jet of air produced was a big red ball, which bounced up and down or revolved in a mysterious manner, apparently unsupported by any visible means. Surrounding the moving attraction were signs advertising various features of "Ky-El-Co" service. The air pump was, of course, driven by an electric motor.

Window Cards in Kansas City Campaign

Interest in some of the clever cartoon advertisements of which the Kansas City Electric Light Company is making use has proved contagious among neighboring central-


You Will Stay In The Dark This Winter
IF YOU ARE CAUGHT WITHOUT ELECTRIC LIGHT
BETTER have your house wired now while you still have a chance to take advantage of our Special Wiring offer, including a 25% reduction in cost, with twelve months to pay in.
LET us estimate the cost of wiring that house of yours.
KANSAS CITY ELECTRIC LIGHT CO.
PHONES BELL HOME 50 GRAND MAIN
1500 GRAND AVENUE

A POST CARD FROM KANSAS CITY

station commercial departments, and copies of these cards have since found their way into various cities and towns in Missouri, Kansas, Nebraska and other states. The Kansas City sketches, one of the best of which is reproduced herewith, were got up as timely reminders of the "light that failed" during the natural-gas shortage this winter, the

lesson being that unless the consumer exercised foresight in having his house wired for electric lights, he might be caught "in the dark." Much amusement has been caused by the sketches, which were mailed as postal cards and were also used as window placards.

Central-Station Results at Holland, Mich.

The municipal light and water plant at Holland, Mich. (described in the *Electrical World* of Feb. 2, 1911), enjoys the double distinction of having had competent management during a number of years and of being one of the few municipal stations in which complete records are kept of the essential factors of the business. The annual report of this plant, in its published form, is an interesting little booklet to those in the central-station business because of the operating and financial facts given. One portion of the report is entitled "Facts and Factors," and contains items computed in accordance with the standard "facts and factors" form which has been used by the *Electrical World* and by the Iowa Electrical Association. This arrangement, which puts much information about the plant in condensed form, is given in Table I.

Since the *Electrical World's* form was originally adopted a number of central-station men have suggested that kilowatts of peak load rather than kilowatts of station rating should be the standard of comparison on items relating to the utilization of apparatus. This suggestion seems well made, as the peak load of a system usually has a more fundamental relation to other items of operation and finance than the kilowatts of station rating. In the case under consideration in Table I the reader can obtain the investment and gross income per kilowatt of maximum peak load by using the figure given for maximum load, namely, 825 kw, and the investment and income figures from Table II.

Other interesting information concerning the Holland plant is given in the second table. This traces the history of the investment since the plant was started in 1894, and shows how the cost of equipment, size of plant, gross earnings and operating expenses have increased from year to year during the eighteen years of plant operation. The water-works investment, earnings and operating expenses are kept separately and analyzed systematically.

The statement is one which shows what can be done by consistent good management, with few mistakes, in a period of eighteen years. The figures should serve to quiet the claims sometimes made concerning the large profits of the business and, on the other hand, to keep unscrupulous central-station owners and promoters from concealing facts as to the profits of the business.

The Holland plant is under the control of a board of public works, with Mr. R. B. Champion as superintendent.

TABLE I—"FACTS AND FACTORS" OF HOLLAND (MICH.) MUNICIPAL PLANT

	1910–11	1911–12
Population	10,490	10,760
Consumers per 100 of population	17.3	19.0
Station rating,* kw	925	925
Station rating per employee,† kw	48.68	48.68
Station rating per capita, watts	88	86
Ratio of station rating to connected load, per cent	33.3	29.2
Average load during operation, kw	222.1	238.0
Ratio of average load to station rating, per cent	24.0	25.6
Annual load factor, per cent	29.2	28.8
Investment per kw of rating	$208.00	$219.00
Investment per capita	18.40	18.88
Gross income per kw of rating	70.87	70.48
Gross income per consumer	36.11	31.85
Gross income per capita	6.24	6.06
Gross income per $100 invested	34.00	31.79
Gross income per kw-hr. generated	0.0337	0.0312
Ratio of expense‡ to gross income, per cent	54.7	53.6
Net earnings per $100 invested	$10.67	$10.38
Total hours' operation for the year	8,760	8,760

CONNECTED LOAD	Kw.
Incandescent lamps	1,856.30
Commercial arc lamps	25.55
Street arc lamps	92.50
Two-phase motors	825.00
Single-phase motors	19.00
Flatirons	344.50
Total load	3,162.85
Metered services for lighting	1,967
Metered services for motors	80
Full-load rating of plant, kw	925
Maximum load, kw	825

TRANSFORMERS	Kw.
Light (53)	488.8
Motors (42)	703.5
Total transformer rating	1192.3

Commencing with the month of May, 1911, a discount of 15 per cent was allowed on lighting rates. Rates for motor service remained net.
*Full load capacity of plant.
†Entire force, station, distribution, clerical and general.
‡Includes interest and taxes but not depreciation.

TABLE II—RESULTS OF OPERATION DURING LIFE OF PLANT, HOLLAND, MICH.

Year Ending Third Monday in March	PLANT			OPERATION		
	Added	Total Cost	Rating, Kw	Gross Earnings	Cost of Product, Interest on Bonds, Loss of Taxes	Gross Profits
1894–5	$15,690.25	$15,690.25	67.5	$5,508.86	$4,859.38	$649.48
1896	14,886.26	30,576.51	137.5	8,736.98	7,715.23	1,021.75
1897	2,901.51	33,478.02	137.5	11,119.25	10,294.30	824.95
1898	613.46	34,091.48	137.5	9,010.80	8,035.56	975.24
1899	6,661.58	40,753.06	192.5	10,945.60	7,792.88	3,152.72
1900	3,411.96	44,165.02	192.5	13,608.73	9,878.15	3,730.58
1901	5,091.55	49,256.57	192.5	14,873.97	10,707.96	4,166.01
1902	8,118.95	57,375.52	250.0	17,616.10	11,955.74	5,660.36
1903	21,481.22	78,856.74	550.0	21,484.41	14,267.81	7,216.60
1904	19,207.07	98,063.81	550.0	26,983.86	17,812.34	9,171.52
1905	7,046.74	105,110.55	550.0	28,753.66	21,242.72	7,510.94
1906	4,986.22	110,096.77	550.0	31,174.68	18,148.30	13,026.38
1907	14,979.40	125,076.17	550.0	39,807.00	27,811.30	11,995.52
1908	12,554.91	137,631.08	550.0	44,698.96	29,364.63	15,334.33
1909	28,642.24	166,273.32	925.0	53,316.50	39,976.33	13,340.17
1910	16,403.30	182,676.62	925.0	61,487.71	36,461.17	25,026.54
1911	10,417.79	193,094.41	925.0	65,556.00	35,855.37	29,700.63
1912	10,074.49	203,168.90	925.0	65,194.23	44,451.91	20,742.32
Total	$203,168.90	.....	925.0	$529,877.12	$356,631.08	$173,246.04

Total profits at beginning of year	$84,846.77
Profits added during year	21,093.48
Total net profits at end of year	$105,940.25

Illumination and Wiring

Electric Fountain at San Diego, Cal.

A small park at San Diego, Cal., has an electric fountain which is unusual in its design and arrangement. Even by daylight, before the water is turned on at noon, the fountain presents a very beautiful appearance as a monument of classic design, for it was important to have the structure in keeping with the architecture of the large hotel in the background.

At 12 o'clock each day the water is set in motion by an electric pump concealed in a chamber under the fountain. This forces the water up through the marble columns to the base of the bronze lantern above the dome. From this point it flows over the prismatic glass of the dome, whose protruding framework of bronze sets the water rushing and seething. Although the fall is thence straight down in a shower to the granite pedestal, the illusion is given of water rising from the base and terminating in a dome-shaped roof of foam. Eight jets of water are also shot at an angle from the sides of the basin to meet the shower between the columns, and together they rush downward

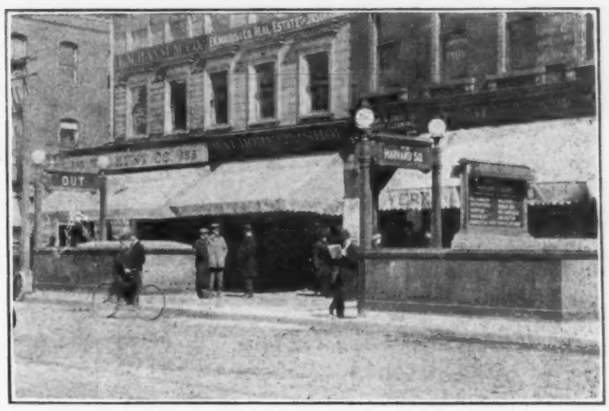
ELECTRIC FOUNTAIN AT SAN DIEGO, CAL.

into the basin in a number of small cataracts. The water is returned to its starting point and is pumped over again and again.

At night the fountain, of course, is at its best. Colored lamps with reflectors are placed under the jets and cascades, and a flasher is operated automatically. Clusters of colored tungsten lamps are arranged under the prismatic glass dome, which subdues their brilliance. The fountain was installed at a cost of $15,000, and the running expenses are said to be not more than $5 a day, as only the services of the park caretaker are required. Mr. Irving J. Gill was the architect for the fountain.

Lighting for Boston Subway Approaches

The Cambridge subway, which is the latest underground rapid-transit line to be placed in service in Greater Boston, is notable among other features for the artistic and efficient character of its electric-lighting equipment. A typical installation of entrance lighting is shown in the accompanying photograph taken on the surface above the Central Square station. The stairway connecting the sidewalk and the outbound platform below is surmounted by two posts, each carrying two 40-watt tungsten lamps in a spherical globe of translucent glass. Between the posts is a sign transparency containing ten 55-volt, 15-watt tungsten lamps, wired in series from the railway feeder circuit. At the right is a double reflector sign, containing two sets of five 15-watt lamps similarly wired ten in series, which shows the connections made by surface cars and trains at the Harvard Square terminal station. The post lamps are connected in series with a stairway lamp of the same wattage. The installation furnishes a good example of recent



LIGHTING FIXTURES AT BOSTON SUBWAY ENTRANCE

tendencies in ornamental and utilitarian exterior lighting and adds another to the many instances of what public-service companies have accomplished along this line.

Bell and Lamp Signal Systems—III

By Sydney F. Walker

In the issues of the *Electrical World* of Jan. 18 and Jan. 25 the former instalments of "Bell and Lamp Signal Systems" appeared. The first instalments gave a résumé of the early growth and development of the use of electricity in mine signaling and a description of some of the systems

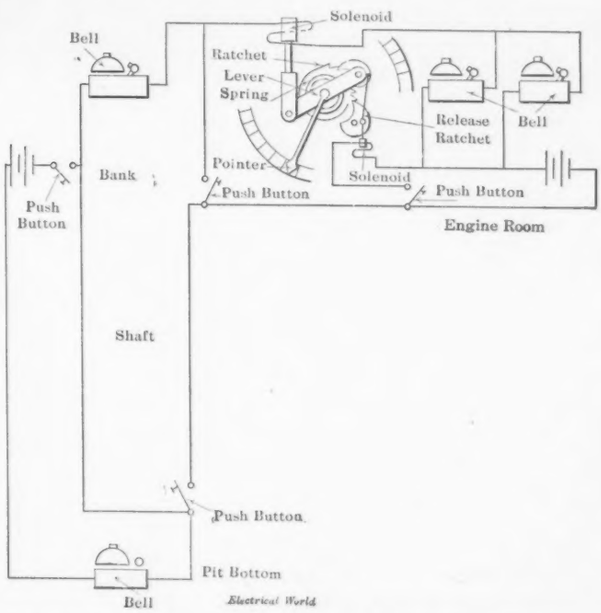


FIG. 8—DIAGRAM OF SIEMENS SHAFT SIGNAL WITH BELLS AND NUMBERED INDICATOR IN ENGINE ROOM

used in well-known collieries of England. The present article deals with signals used in the mine shafts.

Shaft Signals

Shaft signals have not been very extensively employed in the past, partly on account of the heavy first cost as

compared with the old stranded wire knocker and partly on account of the great trouble in keeping them in order. The vanguard mining engineers have tried them with success, and their adoption is becoming more general. There were two great difficulties in keeping shaft signals in repair during the early days, trouble with the wires in the shaft and trouble with the contactors in the pit and on the surface. All mine shafts without exception have water running down their sides, and if insulated wires are used and are stapled to plugs or anything of the kind, as was the practice in the early days of signaling, the water invariably takes its course over the staple, which becomes badly rusted at that point. Conduits were tried at the collieries of Derbyshire and were found to give fairly satisfactory service, but even where this precaution was adopted the modern tendency toward iron conduit and waterproof cases has done much to eliminate this trouble.

In metalliferous mines, where efficient shaft signals would be of the very greatest service, the greatest difficulties arise in connection with their operation, owing to the presence of large quantities of water in the shafts and the greater number of levels. In this class of mines the shafts are nearly always inclined, they follow the "dip" of the lode, and levels are run out on each side of the shaft at certain intervals, so that in deep mines there are a very large number of them. Special arrangements are made in the winding engine on the surface, to enable the "skip," as the cage used in metalliferous mines is called, to be stopped at any level. Thus communication between each level and the surface and between individual levels would be of the

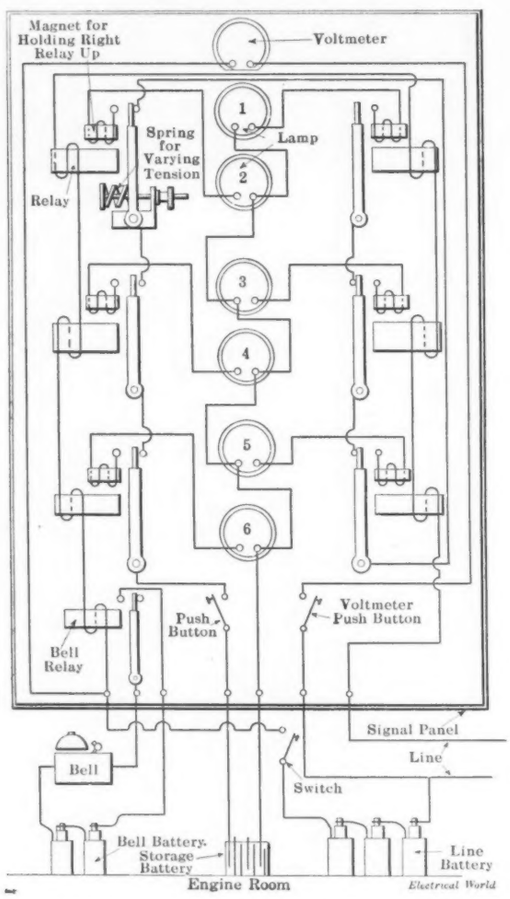
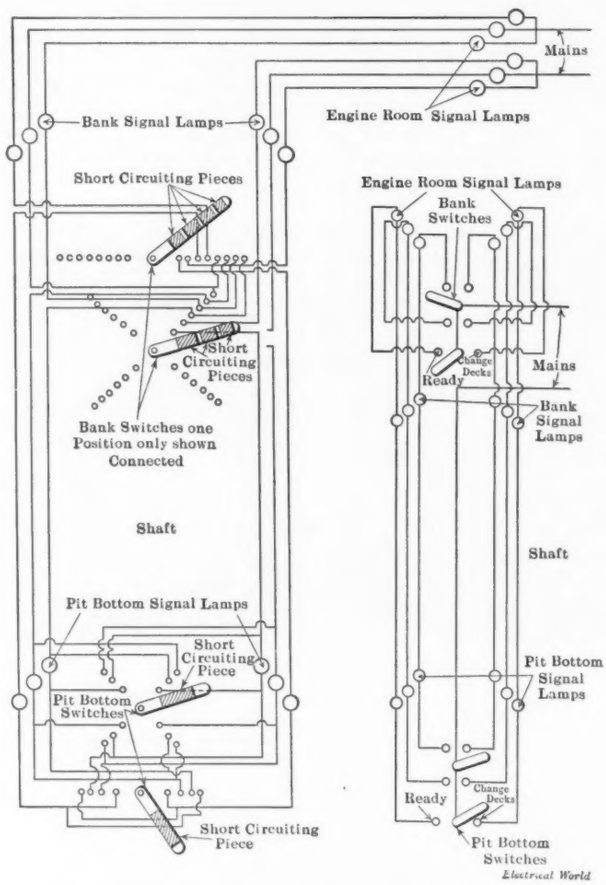


FIG. 9—CONNECTIONS OF INDICATOR OF CHARTON'S RELAY SIGNAL



FIGS. 10 AND 11—DIAGRAMS OF CONNECTIONS FOR SHAFT SIGNAL LAMP INDICATORS

trouble sometimes occurred, owing to the fact that the conduits were not entirely waterproof.

The trouble with the contactors was even more serious. The delicate design of the switches and other apparatus made them unable to withstand the rough handling to which they were subjected by the miners, nor could the contact points be kept free from dirt. This trouble, coupled with the need for economy in insulated wire, led to the adoption of double-contact ringing keys, which operated the local bell circuit and the engine-room signal simultaneously. These keys required constant attention to keep the spring tension high enough and to keep the points from corroding. It appeared to be practically impossible to prevent water from following the wires into the contactor case. This trouble was partly obviated by bringing the contactor terminals to the outside of the case. This left the connection in a position where it was easily accessible for repairs. Difficulties in maintaining contactors are still present, but greatest service. In the Rand mines, where there are usually three divisions of the shaft, one devoted entirely to pipes and conduits, the difficulty of repairing the wires is not so serious.

Modern Shaft Signals

Modern shaft signal systems are installed with all wires inclosed in iron conduits, which follow very closely the conduit system used in wiring buildings for electric light and motor service. All apparatus is fitted with water-tight cases and all joints between the conduits and their cases are carefully made. Then by opening the contactor boxes only when it is absolutely necessary the amount of moisture which reaches the delicate working parts is reduced to a minimum. The iron conduit is sometimes replaced by armored cable. The latest development comprises two complete sets of signals, namely, the bell signals and the visual signals. The bell signals are operated by batteries in the

usual manner and differ very little from the bell signals already described, except that the wiring is carefully protected.

A modification of the simple bell-shaft signal which is illustrated in Fig. 8 has been introduced by Siemens Brothers. The principal feature of the system is a numbered indicator in the engine room, which registers the number of rings given, either by the "banksman" or by the "onsetter" at the pit bottom or level. It is obvious that there may be one or two indicators, one attached to the signal from underground, the other to that from the pit bank. In either case, pressing the contactor at either the pit bottom or the bank rings the respective bell in the engine room and moves on the pointer of the indicator one space. This is brought about by an electromagnet operating a ratchet which moves forward one tooth for each ring.

The visual signals consist of small incandescent electric lamps, placed behind windows in the indicators, and are supplied with current either from a storage battery placed conveniently for the purpose, or, as is more usual, by current from the electrical supply mains of the colliery. For the lamps alternating current is preferable to direct current owing to the reduced wear and tear on the contacts due to arcing. It is very convenient, therefore, to reduce the emf to a convenient voltage for lighting the lamps. In the latest form, which is that introduced by Siemens Brothers and which is shown diagrammatically in Figs. 10 and 11, there are visual indicators in the engine room, on the pit bank and at each of the levels. In each of the indicators there are four separate windows upon which are marked in large lettering the words "Shaft," "Coal," "Men" and "Stop." The indicators are controlled by special switches connected in the line at the pit bank and at each level. The lamps corresponding to each visual signal, in the engine house, on the pit bank and at each level, are connected in series, and they are all lighted simultaneously when the "onsetter" at the level from which the cage is being lifted and the "banksmen" have both set their indicator switches for the same window and have also both set a second switch to "Ready." In the ordinary operation of a colliery drawing from one level the indicator switch at the pit bank and at the level below would be placed at "Coal." This would mean that only coal was being drawn, and the lamps opposite the "Coal" indicators only would be lighted up. Below the indicator, at the pit bank and at the level, is a two-point switch. The "onsetter" or the "banksman" turns the switch to "Ready" when he is ready, and if the switch indicators at the pit bank and at the level are both pointing to the same indicator—for instance, "Coal"—when both switches at the pit bank and at the level point to "Ready," the lamps opposite "Coal" light up at the level, at the pit bank and in the engine room. The engine man receives his ordinary bell signal, but he does not move the cage until he receives the visual signal from the lamp opposite, say "Coal." If men are being carried, the engine man has to be especially careful and coal is not to be raised on one cage while men are being lowered on the other. When men are to be lowered or raised the indicator switch is set at "Men," and the remainder of the procedure is practically the same. When the engine is started an automatic trip gear breaks the lamp circuit and extinguishes the light. When more than one level is being operated or two deck cages are run the two-point switch, which is put to "Ready" when the "onsetter" is ready, is turned to "Change deck," and the engine man then knows that he is either to raise or to lower the cage to enable the other deck to be unloaded or loaded, or is to run the cage to another level.

An emergency signal is provided to be used when the shaft is being examined. It is connected to the lamp window marked "Stop." This signal can be operated from any level, or by the "banksman" at any moment, and is used only in extreme cases.

Recent Telephone Patents

PARTY-LINE SYSTEM

Mr. C. A. Bals has had a second patent granted to him which describes a party-line system. It is a common-battery lock-out system having at each station a high-resistance relay which is connected across the line when the switch hook rises. This relay must operate to connect the instrument. However, it will operate only when the line is not shunted by another station. Thus a lock-out is effected.

ATTACHMENT FOR TELEPHONES

Among the patents granted for attachments on telephones are a receiver supporting arm, patented by Mr. S. C. Sladden, of New York City; an auxiliary mouthpiece for transmitters, patented by Mr. S. S. Williamson, of Philadelphia, and a telephone lock, patented by Mr. C. H. Bard, of Mount Vernon, N. Y. The receiver arm may be clamped to the throat of a desk stand. It consists of a horizontal fixed link and a movable link attached to the first through an adjustable ball-and-socket joint. The movable arm carries the receiver and also a cam adapted to depress the hook-switch lever when the instrument is not in use. The mouthpiece is of sheet metal, and its base is shaped to fit over the front of the transmitter. In this position an internal elastic ring grips the lip of the regular mouthpiece at the front. The metal is well turned in to form a core which leads within the regular mouthpiece, the folded or front edge being shaped to fit the face of the user. The telephone lock consists of a wide band to surround the upright of a desk stand between the hook and the cap at the top of the upright. The band just fills the space with the hook down, and when it is secured in this position by a clamp nut and padlock the use of the telephone by unauthorized persons is prevented.

Letters to the Editors

Invention of the Dynamo

To the Editors of the Electrical World:

SIRS:—I am herewith attaching a copy of an article from an old magazine, dated 1838, describing an early attempt at making an electric motor. Thinking perhaps it might interest your readers, I am sending you this copy for your own use.

I have the original magazine containing this article to settle all disputes that might arise.

Detroit, Mich. J. B. DAILEY.

DAVENPORT, THE AMERICAN BLACKSMITH—THE ELECTRO-MAGNETICK DISCOVERY

Thomas Davenport, a native of Vermont, where he has resided as a blacksmith at Brandon, Rutland County, until within a few months past, in July, 1834, after a year's experience in electro-magnetism, procured for the first time ever known a rotary motion, with that power, the machinery of which is now exhibiting in New York, and exciting the astonishment of every individual who has seen its operation.

Of the origin of this wonderful discovery, which threatens to make as entire a revolution to the mechanical world as that of Fulton in steam navigation, which it may possibly entirely supersede, the publick are naturally curious to learn some particulars. We communicate them in a more authentic and detached shape than they have hitherto appeared.

In the first place it is necessary to premise that neither the works of Farraday and Sturgeon of England, who have made much advance in electrical science, nor those of Orsted of Copenhagen, nor Molle of Sweden, nor of Hare and Henry of America, nor of Ampere of France, can

convey any notion of the extraordinary development and application of electro-magnetick power discovered by our native American Mechanick, Davenport. His name probably in a few years will stand out upon the annals of history as much more prominent than Watt, Arkwright, or Fulton, as they do now above the most ordinary inventors.

Nor, let us add, can even the interesting and well written descriptions in Silliman's Journal, and elsewhere in our newspapers, make intelligible the nature of Mr. Davenport's discovery. In fact, the technical language of science requires an entire new glossary to furnish words to express the thoughts which have sprung up in this new world, whose door has been burst open by the genius of one of our citizens.

Up to the age of thirty Mr. D. steadily followed his profession of blacksmith. In the summer of 1833, he went as was his custom from Brandon to a forge at Crown Point, on Lake Champlain, where he was in the habit of purchasing his iron. He there saw a revolving cylinder with magnetized points, for the purpose of separating the particles of iron from the pulverized ore. "How is this magnetized?" said Mr. D. to the owner. "By Professor Henry's horseshoe magnet, which you see there," was the answer. It was one of a very small description, weighed about three pounds, and had been purchased of Professor Henry himself at Albany. On an exhibition of its powers, in connection with the galvanic battery (Hare's), Mr. D. was so struck with this, to him, entirely novel agent that he immediately demanded the price of the whole apparatus, and purchased the same, and went home absorbed with the useful purposes to which he immediately conjectured it might be applied, and too much engrossed with this dominant thought to remember the load of iron he had come in pursuit of. It is proper to say that previous to this Mr. D. had become acquainted with the nature of the permanent magnet in his excursion with that and the compass among the iron regions of his native state. On his return, he explained to a friend his conviction that the magnet could be made to procure a rotary motion. This friend engaged with him in a series of experiments, which proved abortive, and Mr. D. was shortly after abandoned as a visionary. The same results precisely soon followed with two other persons. He was thus finally and fortunately thrown upon his own resources and himself was the sole discoverer of this great invention, and the architect of his own reputation.

While prosecuting his researches he read nothing but went onward boldly, under the strong impulses of his own native genius, till he struck out the light which, as we believe, will eternize his name and that of his country.

In alluding to his want of all preliminary education and book knowledge, we are convinced, with him, that had his thoughts been entangled and entrammelled with the ideas of other men, his mind never would have been emancipated into the regions of boundless discovery where it has now reached.

The discovery took place in July, 1834. He first went to Middlebury College, Vermont, and exhibited his production, where it met with general approbation. Thence he came to Troy and exhibited it to Professor Eaton; to Princeton and showed it to Professor Henry, who had himself, without Mr. Davenport's knowledge, procured a short time before a vibratory motion up and down with his horseshoe magnet. Mr. Davenport now made some marked improvements in the construction of his machine—principally in changing the poles of the magnets. He then came to exhibit it at Saratoga during the summer of 1836. There he met with Mr. Ransom Cooke, a native of New Haven County, Connecticut, who, taking a deep interest in the magnitude of the discovery, immediately became associated with Mr. Davenport in advancing it to perfection and obtaining for it the approbation of the publick.

In concurrence unanimously we believe with all who have witnessed the operation of this extraordinary and simple apparatus and listened to the eloquent and lucid explanation of Mr. Cooke, we confess our utter amazement at the prodigious change which it manifestly foretells in the immeasurable agent of mechanical power and at the same time, while we see and admire, acknowledge ourselves, for want of language to sustain us, utterly incompetent to impart any correct conception of this marvellous invention to our readers. All we can say is, "Go and be convinced."

Description.—If we were to attempt to give our readers some faint notion of this machine, we would say that it consists of a wheel composed of two iron semicircular arcs, cut across so as to interrupt their formation into a complete circle. That within these are two iron bars or shafts, crossing at right angles, bearing smaller segments of circles on their extremities, nearly touching, as they revolve, the above outer circle, which is fixed. The whole of these are horizontal and covered with silk, and then wound round closely and spirally with copper wire, the wire itself covered with cotton and varnished. On the upright shaft below are two small corresponding semicircular arcs, cut as above. Now these are all connected by two flat copper wires. which lead to Hare's galvanic battery of concentrick copper and zinc plates, in a solution of sulphate of copper. Those generate the electric stream, like fuel to a fire engine, and it is by the two upright wires that touch, then circle below, as their ends alternately rub in the rotary motion against the inside of the two semicircular arcs into which the fixed circle is divided, that the extremities of the semicircular pieces above are alternately made to change their positive and negative poles by the ascending current of galvanism—and thus the principle of repulsion and attraction made to act in concert on the four segments of the shafts above described—keeping up by the magnetization produced a swift rotary motion, which in this machine raises two hundred pounds one foot in a minute. So rapid is the change of poles and the electric velocity of the stream of galvanism that it makes thirty-two thousand revolutions around the wires in a minute. It is a sublime but not wild idea of Mr. Cooke, that a ship's bottom covered with suitable plates and the ocean for its bath, may drive herself along with incredible velocity, at the same time generating abundance of hydrogen to light her onward on the deep.

[An account of the exercises at Brandon, Vt., on Sept. 28 and 29, 1910, in commemoration of the invention of the electric motor by Davenport, was given in our issue dated Oct. 6, 1910.—Eds.]

Steam Railroad Electrification

To the Editors of the Electrical World:

Sirs:—In your recent editorial on "Energy for Railroad Electrification" you state that "it is known too well to need comment that most American railroads have been, first and last, very heavily capitalized, and that in pursuing the reckless policy of buying up competitors at any price many large systems have put themselves on the very last limit of their possible borrowing capacity." Although the railroads may not be in a position to electrify their systems because of their past financial misdeeds, yet your statement is not true in anything like the general way in which it is made. The measure of an undertaking or investment is: What was put into it? What does it produce? With a capitalization of $60,000 a mile, American railroads move more than twice the density of traffic handled by English railroads, which are capitalized at $275,000 a mile. If you will permit me to say so, I think the present difficulty of the steam roads in raising capital for electrification or other improvements is due not so much to their over-capitalization as to reckless misrepresentation and oppressive regulation.

Washington, D. C. Garrett Park.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Rapid Repair of a Water Power Flume

Friday, Dec. 13, 1912, was indeed an unlucky day for the Virginia Railway & Power Company, which suffered on that day a serious washout on its Appomattox water-power canal, two miles west of Petersburg, Va. The north bank and bottom of the channel were carried away for a distance of 200 ft., the damage extending in places to a depth of 35 ft. By quick work, however, the flume was again in service twenty-seven days later. Twenty of these days were required for the actual reconstruction, while seven were lost waiting for lumber. Thirty to 100 men were employed continuously, although the problem of holding labor on the job was one of the major difficulties confronting those in charge of the repairs. Rains which persisted during a number of days made the roads so muddy that the supply wagons sank to their hubs in the mire.

In repairing the washout a new structure 600 ft. long, extending 200 ft. on both sides of the ravine, was built, consuming 100,000 ft. of lumber besides 400 12-in. pine-tree girders cut from the company's woods. Other material required included 22,000 ft. of rubber roofing, which was used between the lumber making the sides and bottom of the trough; three cars of crushed stone; three cars of sand; 1380 bags of cement for lining the bed and tying in the flume to the solid earth at the ends; 3700 cu. yd. of dirt, and several barrels of bolts and nuts, spikes and nails.

The labor expended on the work averaged that of 60 men for twenty-seven days. From one to twelve teams were used in the hauling. The average length of haul on the dirt for filling in the lower 15 ft. of the great hole was 500 ft. The haul on the lumber and other materials was many times longer. Every class of labor, from common laborers and teamsters to skilled carpenters, was used in the work.

The cost of the new flue will approximate $10,000. This outlay is but a part of the expense to which the company was put while the canal was being restored, for while the

FIG. 1—LARGE EXCAVATION MADE BY WATER

canal was out of commission the steam-power plant at the station furnishing Petersburg with its light and power was in operation. The cost of coal alone during the first eighteen days of the operation of the steam plant was $3,075. Coal used in the last nine days will run up the expense proportionately. The payroll at the steam plant was almost doubled during this period, twenty-two men being required there. The force at the power house under normal conditions is twelve.

The new trough of the canal has a width of 24 ft. at the bottom, which rests on benches 9 ft. above the ground. This space will be filled in with earth and the wooden supports and braces reinforced later on. The capacity of the flume when filled with water to the depth of 8.5 ft. will

FIG. 2—THE RECONSTRUCTED FLUME

make possible the development of 6000 hp, about twice as much as it will be called upon to furnish for some time yet.

The work of replacing the canal washout in the short time in which it was accomplished was carried out under the general direction of Mr. H. R. Palmer, superintendent of light and power for the Virginia company. As evidence of the confidence in which the company is held in the community affected by the recent interruption and the good-will felt for it, it is of interest to note that during the period when the service was not up to standard, the local superintendent, Mr. J. E. Harvill, was able to renew a five-year contract for street lighting for another equal period, including also the lighting of public buildings. In addition a "white way" was created on Sycamore Street from Oak to Old Street, requiring the installation of forty arc lamps in addition to the regular street lighting.

Plant Chimneys for Burning Crude Oil

The necessary heights for chimneys for fuel-oil plants are much less than ordinarily supposed when the boilers are operating at rating and considerably greater than usually supposed when there are heavy overloads. A chimney of undue height, as pointed out by Mr. C. R. Weymouth, of San Francisco, Cal., in a paper before the American Society of Mechanical Engineers, New York, Dec. 5, will take an excessive quantity of air for combustion and permit an excessive load on the boilers, both resulting in a large waste of fuel.

When the chimney height is limited to that necessary for economical air supply at the desired rate of load, it will be impossible for the most careless fireman to cause material loss of economy, either by overload or excess air supply or by abuse of boilers due to overload. In this sense the

chimney may become an important and inexpensive means for boiler-plant regulation and in many ways a safeguard against careless firing. Such usage is, of course, of greatest effect in plants operating at uniform load. The San Francisco earthquake of April 18, 1906, considerably reduced the height of most masonry chimneys and led to an active collection of chimney data. Many of the results apparently were contradictory. Certain chimneys reduced to a height of 30 ft. gave the usual boiler capacity, and others reduced to a height of 75 ft. showed under certain conditions of service a decrease in boiler capacity.

Altitude also effects a considerable difference in the results. The error commonly made in the consideration of stack capacities at altitudes is to assume that a given grade of fuel at a fixed boiler rating will require at an altitude the same draft, measured in inches of water, at boiler damper as at sea level. It is evident that to develop a given boiler horse-power requires a constant weight of chimney gases and air for combustion. Hence as the altitude is increased the density is decreased and, correspondingly, the velocity through the furnace, the bed of coal or the firebrick checkerwork and the boiler passes must be greater at altitude than at sea level. The mean velocity, therefore, for a given boiler horse-power and constant weight of gases will be inversely proportional to the barometric pressure. And the velocity head, measured in column of external air, will be inversely proportional to the square of the barometric pressure.

TABLE OF APPROXIMATE MAXIMUM CAPACITIES (ACTUAL BOILER HP) FOR OIL-BURNING CHIMNEYS (BOILERS 150 PER CENT RATING)

Diameter, In.	Area, Sq. Ft.	HEIGHT IN FEET ABOVE BOILER-ROOM FLOOR LINE							
		80	90	100	110	120	130	140	150
18	1.77	63	75	84	91	96	101	104	108
21	2.41	90	108	121	131	139	146	151	156
24	3.14	123	148	166	180	191	201	208	215
27	3.98	161	195	219	238	253	265	276	285
30	4.91	206	249	280	304	324	340	354	366
33	5.94	256	310	349	381	405	426	444	459
36	7.07	312	379	427	466	497	523	545	564
39	8.30	376	455	514	561	599	631	657	681
42	9.62	443	539	609	665	711	749	782	810
45	11.05	518	630	713	779	834	879	918	952
48	12.57	599	729	287	904	967	1,020	1,070	1,110
54	15.90	779	951	1,080	1,180	1,270	1,340	1,400	1,460
60	19.64	985	1,200	1,370	1,500	1,610	1,710	1,790	1,860
66	23.76	1,220	1,490	1,700	1,860	2,000	2,120	2,220	2,310
72	28.27	1,470	1,810	2,060	2,260	2,430	2,580	2,710	2,820
78	33.18	1,750	2,150	2,460	2,710	2,910	3,090	3,250	3,380
84	38.49	2,060	2,530	2,900	3,190	3,440	3,650	3,840	4,000
90	44.18	2,390	2,950	3,370	3,720	4,010	4,260	4,480	4,670
96	50.27	2,750	3,390	3,880	4,290	4,630	4,920	5,180	5,400
102	56.75	3,140	3,870	4,440	4,900	5,290	5,630	5,930	6,190
108	63.62	3,550	4,380	5,020	5,550	6,000	6,390	6,730	7,030
114	70.88	3,990	4,920	5,650	6,250	6,760	7,200	7,590	7,930
120	78.54	4,440	5,490	6,310	6,990	7,560	8,060	8,490	8,890
126	86.59	4,930	6,100	7,020	7,770	8,410	8,970	9,460	9,900
132	95.03	5,450	6,740	7,760	8,600	9,310	9,930	10,500	11,000
138	103.90	5,990	7,420	8,530	9,460	10,300	10,900	11,600	12,000
144	113.10	6,550	8,120	9,350	10,400	11,200	12,000	12,700	13,300
156	132.70	7,760	9,630	11,100	12,300	13,400	14,300	15,100	15,800
168	153.90	9,060	11,300	13,000	14,400	15,700	16,800	17,700	18,600
180	176.70	10,500	13,000	15,100	16,700	18,200	19,900	20,600	21,600

For chimneys operating at altitude it is necessary to increase not only the height but also the chimney diameter. Corresponding to the increase in height, there is an added resistance within the chimney owing to the friction of the additional height. This frictional loss can be compensated by a suitable increase in the diameter, and when so compensated it is evident that the chimney height must be increased at a ratio inversely proportional to the square of the normal barometric pressure.

Based on 150 per cent as the ratio of actual boiler hp to rated boiler hp, and assuming sea-level atmospheric pressure and 80 deg. Fahr., the author presented the accompanying table of approximate maximum capacities measured in actual boiler hp. These data apply to steel chimneys with short flues, the chimneys being centrally located over stationary B. & W. boilers. Other conditions are: Draft in inches at boiler outlet, chimney side of damper, 0.30; corresponding excess air through boiler, per cent, less than 50; assumed excess air supply for determining boiler efficiency, chimney diameter and draft resistance of chimney and breeching, per cent, 50; assumed temperature of gases leaving boiler, 525 deg. Fahr.; assumed temperature of gases entering chimney, 500 deg. Fahr.; assumed boiler efficiency, working, not test conditions, 73 per cent; assumed pounds of chimney gases per actual boiler hp, 54.6.

Sparking and Burning of Commutator

I have charge of an old two-pole lighting machine which is rated at 100 amp, 115 volts and 1500 r.p.m. It has been giving trouble for some time. For several days it runs all right, but will then begin to spark and to blacken two or three bars. In two nights it will blacken all the way round, the whole armature getting hot. After smoothing the armature it again runs all right for a night or two. The load never exceeds 60 amp, and I have tested the machine for shorts and grounds. W. M. G.

This trouble may be due to a defective brush-holder which is loosened by a high bar on the commutator. After the machine has been in operation the brush-holder permits the brush to spark, following which the burned place on the commutator contributes to this progressive destructive action. Proper brush mounting should avoid this trouble.

Fusing the Neutral at the Service Cut-Out

A large Western central-station company now insists that in installations connected to its lines the neutral shall not be fused at the service cut-out, but that solid copper connection be used instead. Is this omission of the middle fuse desirable in the case of both grounded and ungrounded neutrals? A. L. S.

In case the three-wire load is unbalanced, blowing of the neutral fuse may impose excessive voltage conditions on the lightly loaded side of the circuit. Again, a short-circuit occurring between the neutral and one of the outside wires of the circuit, inside the service cut-out, might cause the neutral fuse to blow first, leaving the outer fuse intact, but imposing the full 220-volt pressure across the 110-volt apparatus in the remaining side. On the other hand, consider a system which is operated with all wires normally clear of ground and the neutral unfused at the house cut-outs. If the neutral accidentally becomes grounded inside a house, as may easily happen without warning, and later one of the outer wires becomes grounded outside on the line somewhere, a dangerous short-circuit condition will exist in the neutral wiring inside the house, without the intervention of any fuse protection whatever. Such a contingency as that last described seems unlikely, but is nevertheless possible, and in such a case the mission of the neutral fuse might cause serious damage and expense. In determining on the use or omission of the neutral fuse, one is confronted with some such dilemma as presents itself in certain problems of grounding transformer secondaries. In the present inquiry, however, the duty of the company seems clear, as long as the neutral is to be securely grounded at its station, to insist on solid neutral connections at customers' cut-outs, thus securing the important protection to apparatus mentioned in the first part of this reply. However, the large proportion of instances in which grounded neutrals are employed makes this construction practically the standard, whereas ungrounded systems are to be regarded largely as exceptions to the general rule, particularly with present three-wire direct-current circuits. Of course, if each individual branch circuit is properly fused at its indicated amperage, a measure of protection will be afforded unbalanced 110-volt apparatus, even in the case of the opening of the neutral circuit by the blowing of the middle fuse at the customer's service cut-out.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Improving the Power-Factor.—MILES WALKER.—A paper read before the British Institution of Electrical Engineers on the design of apparatus for improving the power-factor of alternating-current systems. The principles involved in the design of apparatus for improving power-factors are discussed. Leblanc's phase advancers are described, and the design of a phase advancer is considered in detail. Some details are also given illustrating the performance of phase advancers.—London *Electrician*, Jan. 10, 1913.

Single-Phase Commutator Motors.—M. LATOUR.—Some further notes on the design of single-phase commutator motors. Among the difficulties which the construction of the repulsion motor would offer at higher speeds the greater thickness of the magnetic circuit should be mentioned. The efficiency of the series motor approaches the efficiency of the direct-current motor when the frequency is reduced. With increased speed and increased number of poles the same series motor tends to operate at the same efficiency with direct current and with alternating current. If a larger amount of iron is admitted the iron losses become less with low frequency; it is, therefore, incorrect to say that the repulsion motor has inherently higher iron losses than the series motor for a frequency of fifteen cycles per second.—*Elek. Zeit.*, Dec. 26, 1912.

Transformers.—HENRY.—A review of present tendencies in the design of transformers with special reference to French practice. The author deals with the design of the magnetic circuit, the winding, the insulation, the general design, the methods of cooling, and finally gives the following rules for the choice of a transformer type. For emf above 30,000 volts oil transformers are recommended. For cooling of transformers in central stations with large units water cooling is always to be recommended if this method is commercially practicable. The circulation of the oil should be considered only when water cooling is found to be impracticable. In central stations of medium size with smaller transformers air cooling with natural or forced draft is recommended. With single pieces of transformers natural cooling may be relied on. If the emf is less than 30,000 volts, the recommendations are as follows: In large central stations water cooling should be used when possible; if this is not the case, use should be made of air cooling with artificial draft. In central stations of medium size with smaller transformers air cooling with natural or forced draft is recommended. With single pieces of transformers natural cooling may be relied on. If the emf is less than 30,000 volts, the recommendations are as follows: In large central stations water cooling should be used when possible; if this is not the case, use should be made of air cooling with artificial draft. In central stations of medium size dry transformers are recommended with natural or forced draft according to the circumstances. In the case of single transformers the natural air cooling is sufficient. Recent advances have been made not only in the increase of rating but also in greater robustness of the construction and in reduction of the losses.—*L'Industrie Elec.*, Vol. XXI, 1912, pages 5, 17, 31, 55, 81; translated in abstract in *Elek. Zeit.*, Dec. 26, 1912.

Lamps and Lighting

Ductile Tungsten and Molybdenum.—A note on a recent British patent (No. 12,869, Jan. 2, 1913) of the Westinghouse Metallfaden Glühlampenfabrik. The metal or alloy to be treated is first heated and then cooled slowly while under pressure. This is effected by embedding the body in a molten mass or heated mold, which cools slowly and so exerts the required pressure.—London *Elec. Eng'ing*, Jan. 9, 1913.

Generation, Transmission and Distribution

Energy Supply in South Africa.—A. VAN DER HAM.—A historical review of the developments of electrical supply of the Witwatersrand in the Transvaal. Two stations, one for 2500 kw and the other for 3700 kw, were erected as early as 1895, but were not very successful on account of the Boer war. In 1906 great interest was aroused by a scheme to develop the Victoria Falls, where from 300,000 hp to 600,000 hp was available. But, for financial reasons, the scheme was not carried out, especially as sufficiently large contracts for power could not be obtained in advance to justify the very large outlay of money. It was then decided to erect steam stations since coal is rather cheap in the Transvaal. The gradual development of different companies and their final consolidation into the Victoria Falls & Power Company is sketched. The erection of new plants was turned over by the English company to a German firm, the Allgemeine Elektricitäts Gesellschaft. In 1903 there were on the Witwatersrand 397 generators with an aggregate rating of 20,000 kw. In 1909 there were 506 generators with 76,000-kw rating. The number of motors increased at the same time from 724 to 3022. The increase in the next years should have been still greater. When the new stations of the Victoria Falls & Transvaal Power Company are finished it will be able to sell 500,000,000 kw-hr. per year to the different gold mines in the district. According to the Transvaal power act of 1910, 25 per cent of the net earnings of an electric station must be distributed among the consumers, while the station is also obliged to revise the tariff from time to time and to make changes when necessary. The Victoria Falls & Transvaal Power Company furnished up to January, 1911, electrical energy at 1.5 cents per kw-hr. During 1911 the price was 1.12 cents per kw-hr. On Oct. 1, 1912, it was to be reduced to 1.05 cents per kw-hr. The central stations expect to get a load-factor of at least 70 per cent, while the gold mines expect to save from 16 to 24 cents in the expense for energy per ton of ore.—*Elek. Zeit.*, Jan. 9, 1913.

Installations, Systems and Appliances

Oil Circuit-Breakers.—MAX VOGELSANG.—An article on high-power oil circuit-breakers. Details are given of a short-circuit test in which a three-pole oil circuit-breaker for 10,000 to 20,000 volts and 200 amp was subjected to a short-circuit test with 23,000 hp, the voltage being 12,000 and the frequency 25 cycles. The circuit-breaker operated with perfect satisfaction. It is emphasized that the speed with which the contact is broken is of greatest importance and that this must be one of the leading considerations in the design. In order to get greater safety it is sometimes recommended to install circuit-breakers for a larger current than is necessary, but as this necessarily means more heavy construction, and therefore greater inertia and less speed in breaking the circuit, this practice is a mistake. A properly designed and properly handled oil circuit-breaker is a quite reliable piece of apparatus.—*Elek. Zeit.*, Jan. 13, 1913.

Switchboards for Alternating-Current Stations.—C. H. SANDERSON.—There are three distinct classes of switch-

boards which are suitable for alternating-current stations: the "self-contained" panel type, the "remote mechanically controlled" type and the "electrically operated" type. The principal factors influencing a choice of one over the other two classes are the power to be handled, the essential operating features, the space required and the permissible cost. The author gives a comparative discussion of the three classes of switchboards as regards these factors. The article is profusely illustrated by diagrams.—*Elec. Journal,* January, 1913.

Storage Batteries.—D. BASCH.—In a continuation of his serial on storage batteries in modern electrical engineering the author discusses storage-battery installations for isolated lighting plants, with reference to ratio of generator and battery and charging and lighting requirements of different installations; private and public garages for charging the batteries of electric vehicles, with reference to the various kinds of charging source; ignition battery outfits, and automatic cut-outs for battery charging.—*Gen. Elec. Review,* January, 1913.

Electricity on Board Ship.—An illustrated account of the electrically driven auxiliary machinery on the steamship *Fauvette,* including the generating plant, controlling gear, a windlass, winches and cranes.—London *Electrician,* Jan. 3, 1913.

Grounded Versus Ungrounded Neutrals of Alternating-Current Networks.—An account of the continued discussion in Newcastle of J. S. Peck's paper abstracted in the *Digesst,* Dec. 21, 1912. (See also the *Digest,* Jan. 4, 1913.) C. Vernier said that he is a firm believer in grounding everywhere, and most certainly in the case of high-tension overhead lines. He instanced a case of an overhead line, where the neutral was left ungrounded, on which one of the lines grounded on a bracket insulator and all went well until another ground occurred on another phase in a motor in a neighboring pit, with the result that some switch gear at the power station was wrecked and a serious shut-down followed. He could not see the advantage of disconnecting the neutral in certain cases in order to make telephone circuits workable, because telephone disturbances are mostly due to electrostatic causes, and with one phase grounded the whole electrostatic balance of the system is upset. He attributed the freedom from accidents in England to the practice of grounding the neutral in distributing networks. He agreed with the author that it is not worth while to ground the neutral merely for the sake of being able to cut down the insulation, at least up to 50,000 volts, but for very high line voltages, say between 80 kilovolts and 120 kilovolts, it might be worth while to do so, especially where corona effects are present to take care of pressure rises. It was suggested at the Manchester discussion that a high-tension line should not necessarily be cut off, on a fault, in order to maintain continuity of supply, but he most strongly disagreed, as it savored of balancing the cost of a duplicate supply against danger to human life. The latest development on protective gear, namely, the "split conductor" system, promised to be of the greatest importance in regard to the question of safety, as it can be made to operate on small ground faults, and, in the event of a line breaking, in the most positive manner. W. M. Thornton remarked, with respect to surges, that the real oscillations which break down the insulation of a system originate in the flame of the arc between phases by reason of its capacity, incandescent metallic vapor being an excellent example of a conducting dielectric and the capacity for a given size in such a condenser being relatively very large. The combination gave a condenser of appreciable capacity in series with the line, and such a system could resonate with great violence. P. V. Hunter said that his experience of ungrounded neutrals had been gained on the Durham collieries system, and he had noticed the tendency for faults to occur at more than one place at a time. He thought that being able to run with the neutral insulated tended to slow repair work, and as a fault on such a system took some time to locate there was always the danger of another fault occurring and thereby causing a shut-down. He had known several cases where high voltages had occurred on quite small systems with insulated neutrals.—London *Electrician,* Jan. 10, 1913.

Traction

Spanish Single-Phase Railway.—An illustrated description of the Pamplone-Aoiz-Sanguesa railway in the province of Navarre in Spain. The railway is operated by single-phase energy generated in a water-power station. The emf of the trolley line is 6000 volts with the exception of part of the line inside the city of Pamplone, where the trolley line emf is 600 volts. There are two kinds of motor cars, larger ones with four motors of 60 hp each and smaller ones with two motors of 60 hp each. The cars contain, besides the motors, the transformer, which reduces the emf from 6000 volts to 600 volts. The motors are designed according to the patents of Latour. They have four poles and a rating of 60 hp at 735 r.p.m. and 600 volts. The curves for efficiency, power-factor, horse-power, revolutions per minute and starting torque are given in Fig. 1. The curves are the results of tests made with a constant emf of 600 volts. The frequency is 25. This is the first single-phase railroad in Spain, and it has been in successful operation for two years.—*Elek. Zeit.,* Jan. 9, 1913.

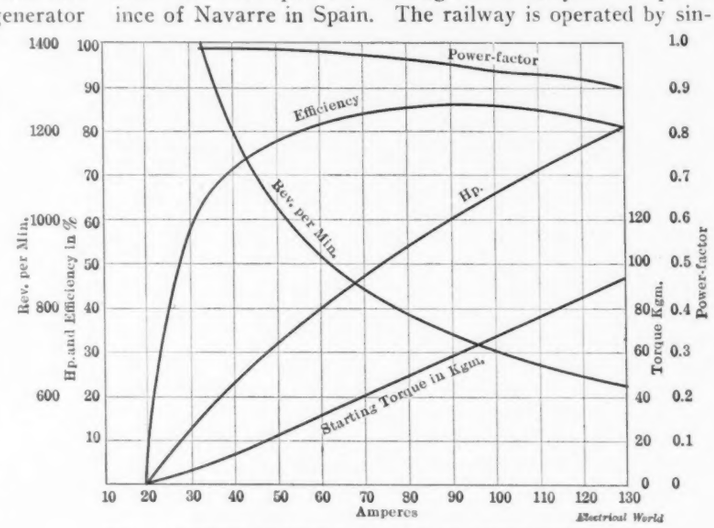


FIG. 1—CURVES SHOWING RESULTS OF MOTOR TESTS

Electrophysics and Magnetism

Radiation.—S. B. MCLAREN.—A highly mathematical paper on the theory of radiation. To save the "ether" it is necessary to give up the classical mechanics. This paper shows that the theory of radiation can proceed without using the principle of minimum action. The author accepts Einstein's atomism for matter but not for radiation. The hypothesis that radiation is a continuous wave motion appears to him indispensable.—*Phil. Mag.,* January, 1913.

Excitation of Gamma Rays by Alpha Rays.—J. CHADWICK.—In a preliminary account of experiments which establish the fact of the excitation of gamma rays when alpha rays impinge on matter.—*Phil. Mag.,* January, 1913.

Radiation of Alpha Particles.—E. MARSDEN AND H. RICHARDSON.—An account of an experimental investigation of the retardation of alpha particles by metals by means of the scintillation method.—*Phil. Mag.,* January, 1913.

Ionization.—S. J. PLIMPTON.—An account of an experimental investigation of the recombination of ions produced by Roentgen rays and the law according to which this re-

combination takes place at varying pressures in the gas.—*Phil. Mag.*, January, 1913.

Photo-Electric Properties of Thin Films of Platinum.—J. ROBINSON.—It was shown by Stuhlmann that the photo-electric effect of thin films of different metals deposited on quartz depends on the thickness of the film and on whether the film is on the side of the quartz facing the source of light (incident effect) or on the side away from the source (emergent effect). He measured the ionization currents in air and found that when the films are thin enough the ratio of emergent to incident (*E* to *I*) currents is greater than unity, and for thicker films less than unity. For thin films the ratio is constant and equal to 1.14 for platinum. In a former paper by the present author it was shown that this dissymmetry can be separated into two quite distinct effects, as regards (1) the velocities of the electrons emitted and (2) the actual numbers of electrons emitted. The films were deposited at low pressure, and then a liquid-air vacuum was established and measurements made as quickly as possible afterward. In this way it was hoped that true values for the velocities would be obtained. For both the photo-currents and the maximum velocities of the electrons similar curves to that of Stuhlmann for the ratios (*E* to *L*) of ionizations were obtained, as the thickness of the film was altered; that is, for thin films the emergent velocities and currents were larger than the incident velocities and currents, and vice versa for thick films. It was also found that the dissymmetry for the velocities was not so marked as for the currents. The present investigation was undertaken to get more knowledge of these effects. There is a certain thickness of film for which the ratio of *E* to *I* currents equals unity, and also a thickness for which the ratio of *E* to *I* velocities equals unity. Experiments show that for the same source of light these two thicknesses of film are the same. The dissymmetry for velocities is not so strongly marked as for currents. As the thickness of film increases through 10^{-7} cm, the photo-current increases suddenly. The ratio of *E* to *I* currents is constant for films thinner than 10^{-7} cm and begins to diminish after the sudden increase in current has set in. Radiations from the spark produce much quicker electrons than those from the arc. The dissymmetry is more strongly marked the quicker the electrons are produced. It is shown that it is possible that photo-electrons possess sufficient energy to ionize molecules of platinum, and that it is this which leads to the best explanation of the sudden rise of photo-current at 10^{-7} cm. The thickness of film which gives the sudden rise in current is the same for slow and quick-moving electrons. The orientation of the plane of polarization of the light has no influence on the dissymmetry. —*Phil. Mag.*, January, 1913.

Units, Measurements and Instruments

Moving-Coil Instrument.—An illustrated description of a new moving-coil instrument designed by J. W. Record for

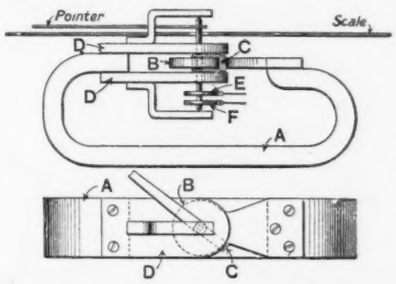


FIG. 2—DIAGRAM OF GENERAL ARRANGEMENT

direct currents in which the scale and range of the instrument is greatly enlarged beyond 90 deg. while the scale is practically evenly divided throughout its entire length. The coil moves not about its axis as usual, but about one of the vertical sides, which is taken through a hole in the core. The two horizontal sides of the coil are used for cutting the flux. This is rendered possible by the construction indicated in Fig. 2, when the magnet is seen to be in the form of a C. One pole carries the core *B*. The coil *C* passes through the center of the core and thus embraces half of it, and it is so shaped that the coil may swing over an arc of about 300 deg., being limited only by the neck. The other limb of the

FIGS. 3 AND 4—THE MAGNET AND THE MOVING COIL

magnet is fitted with pole-pieces *D*, which are brought above and below the core, so that the flux through the latter divides and passes upward and downward into these pole-pieces. The coil is carried by jeweled brackets, and connection is made by two spiral springs, *E* and *F*, wound in opposite directions to eliminate errors. A view of the magnet is shown in Fig. 3. It serves as a girder or foundation for supporting the lighter portions of the instrument. To this magnet are bolted the pole-pieces. The double air-gap is bounded by flat surfaces. The two air-gaps are not in series, which would make a total gap equal in length to twice one of them, but are in parallel; thus the magnetic reluctance is reduced by the addition of another air-gap. Great permanence of the magnet is, therefore, secured, together with freedom from external interferences and a strong working field. The active conductors of the coil are at right angles to its axis of rotation, and the idle length of conductor is exceptionally short compared with the useful length. This results in a very low resistance coil, enabling the instrument to work with shunts having the usual drop of 0.075 volt. Other advantages also arise from the extreme smallness of the moving coil (see Fig. 4). The resistance of the frame itself is low, and as the instrument is damped by eddy currents produced in it, these currents are correspondingly high and the damping marked. The scale is approximately three times the usual length for an instrument of the same size. Variations in current which which cannot be read with an ordinary instrument produce considerable deflection on this pattern. If, on the other hand, such high accuracy is not required, then the advantage of a long scale can be felt in other ways, namely, that one shunt of the instrument is equal to three shunts of the ordinary type, and in calibrating commercial instruments the avoidance of repeatedly changing the shunts is a gain in time. This instrument gives three times the deflection of an ordinary instrument for the same expenditure of energy, or one-third of the shunt losses for equal deflection. —London *Electrician*, Jan. 10, 1913.

Electrolytic Condenser.—K. SIEGEL.—A translation of his recent German paper on an electrolytic condenser and its application to a sparkless type of contact-breaker. The paper is the outcome of experiments made on electric clocks with a view of devising a sparkless contact-breaker for connection to the seconds pendulum. The best results for that purpose were obtained with iron electrodes in alkaline solutions.—London *Electrician*, Jan. 10, 1913.

Telegraphy, Telephony and Signals

Dielectrics in Alternating-Current Fields.—G. L. ADDENBROOKE.—An account of an experimental investigation of the properties of dielectrics in alternating-current fields (gutta-percha). The author gives figures for the dielectric loss in gutta-percha when subjected to very low frequencies, such as those used in submarine cable work. The temperature coefficient is found to be much less for alternating

than for continuous pressure.—London *Electrician,* Jan. 10, 1913.

Resonance in Wireless Telegraphy.—W. H. Eccles.—A paper illustrated by diagrams on a comparison between spark systems and continuous wave systems. The various methods used in wireless telegraphy are compared from the point of view of the degree in which they respectively utilize the principle of resonance. Formulas are developed which show how nearly the modern spark methods approach the ideal resonance that would be attained by a perfect high-frequency alternator. The conclusion is that there is not much room for improvement over the modern spark methods in respect of transmission of energy from the sending antenna to the receiving antenna.—London *Electrician,* Jan. 10, 1913.

Impedance and Attenuation of Cables.—Charles E. Hay.—An article illustrated by diagrams describing a method of measuring the characteristic impedance and the attenuation constant of cables with apparatus available in any laboratory.—London *Electrician,* Dec. 20, 1912.

Radiogoniometer.—An illustrated description of the latest form of radiogoniometer exhibited at the recent exhibition of the Physical Society in London. It is the wireless direction finder on the Marconi-Bellini-Tosi system. When installed on board ship it enables the direction from which signals are received to be determined within a few degrees, a matter of great importance in time of fog or when seeking a vessel in distress. It can also be used for directive signaling over a moderate range. The special aerial em-

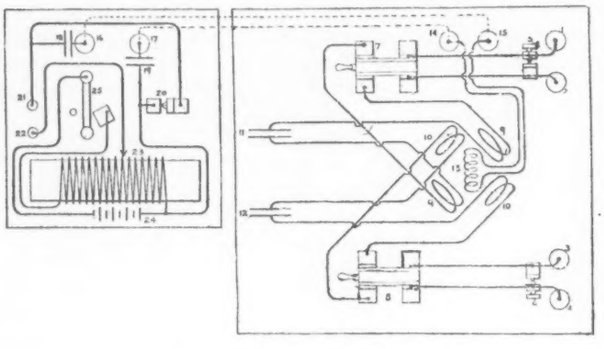


FIG. 5—CONNECTIONS OF THE RADIOGONIOMETER

ployed consists of two equal loops suspended in vertical planes and crossing one another at right angles. Each of these is connected in series with a coil and condenser. The coils are of equal size and cross at right angles; the condensers are also equal and can be simultaneously adjusted for tuning the aerials. A third coil inside the crossed coils, called the exploring coil, is mounted on a vertical spindle. It is connected with a detector consisting of a pair of telephones and a crystal rectifier. The connections are shown in Fig. 5, in which 1, 2 are the terminals of the first aerial loop, 3, 4 the terminals of the second aerial loop, 5 the protecting gap for the first aerial, 6 the protecting gap for the second aerial, 7 the switch for the first aerial circuit, 8 the switch for the second aerial circuit, 9 the fixed coil of the first aerial circuit, 10 the fixed coil of the second aerial circuit, 11 the condenser for the first aerial circuit, 12 the condenser for the second aerial circuit, 13 the exploring coil, 14, 15 the terminals for connection to detector, 16, 17 the terminals for the connection to the direction finder, 18, 19 the blocking condensers, 20 the crystal holder, 21, 22 the terminals for connecting to telephones, 23 the potentiometer, 24 a battery of dry cells, 25 a battery switch. The principle of the instrument is as follows: Each aerial loop is a directional aerial, which receves best when its plane is in the direction of the sending station and receives nothing when its plane is at right angles to that direction. Usually both aerials are more or less inclined to the direction of the signals and receive signals of corresponding intensity, the resultant effect of which is communicated to the exploring coil. When the latter is in the position which gives the maximum strength of signals the pointer attached to the spindle indicates the direction of the sending station, if the instrument has been properly fixed with regard to the aerials. A simple testing instrument is used to verify the orientation, resistance and insulation of the aerials.—London *Elec. Review,* Jan. 10, 1913.

Miscellaneous

Yearly Report.—The last yearly financial report of the Siemens-Halske company discusses in a general way the present commercial situation in Germany. The scientific and technical character of the extended pioneer work of the company is emphasized. Financing of other companies has been undertaken only in cases where technical pioneer work was to be undertaken. The competition between the various firms in the German electrical industries had led to a difficult situation. With respect to engineering regulations and standardization the German Association of Electrical Engineers has done very effective work, but with respect to the commercial situation there is no such ruling influence, "although much could be done to relieve essential troubles. But one should not think of monopolies."—*Elek. Zeit.,* Jan. 2, 1913.

British Patents.—A list of British patents of interest to electrical engineers which are to expire during 1913.—London *Electrician,* Jan. 3, 1913.

Organization.—A. Trevor Dawson.—His presidential address to the Junior Institution of Engineers in London on staff officers in industrial works, their scientific training and duties.—London *Electrician,* Jan. 3, 1913.

Book Reviews

Magneto and Electric Ignition. By W. Hibbert. New York: Macmillan Company. 154 pages, 90 illus. Price, 70 cents.

A very practical little handbook on ignition of gaseous mixtures in engine cylinders by magnetos, batteries and induction coils, especially in relation to British automobile engines. The eight chapters of the book cover respectively: an introduction, the high-tension magneto, faults and their remedy, gearing, other magnetos, ignition by battery and coil, faults in cells, combinations. The book will be useful to all who operate automobiles or are interested in them. The descriptions are clear and the diagrams simple.

Electricity, Its History and Development. By William A. Durgin. 176 pages. Chicago: A. C. McClurg & Company. Price, $1.

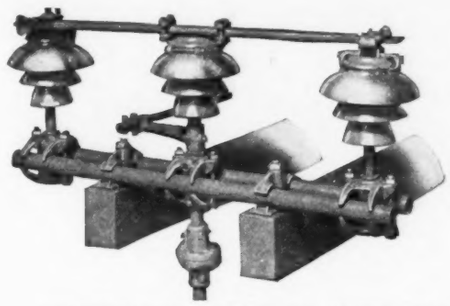
An attractively written little volume, easily carried in an overcoat pocket, and addressed to the man in the street rather than the electrically trained man. It briefly describes in simple and untechnical language the development of electric appliances from the days of ancient Greece until the present time, especially the last twenty years and in the United States. There are fifteen chapters, and their titles are as follows: The occasional discoveries of twenty-three centuries; the American Prometheus; the convulsed frog-leg and what came of it; the electric conflict; an anchor ring and what it held; the units; the sympathetic needle; from telegraph to telephone; the electric arc; the heat of Niagara; the bamboo light; the electric revolution; a blacksmith and his dream; the mystery of the iron box; the spirit of electricity. The book offers easy reading to all interested in the evolution of electrical applications, and incidentally conveys much elementary electrical information.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Open-Air Disconnecting Switch

A type of switch which may be mounted on a pole top and used for opening branch lines, for disconnecting transformer banks or for sectionalizing transmission lines, or which may be installed on the roof of a substation for diverting energy past the station, or for disconnecting a portable substation from the line, has recently been put upon the market by the Electrical Engineers' Equipment Company, of Chicago, Ill. The switches are built with clamped pipe arms affording a construction which is rigid yet adaptable to standard pole framing. Three designs are now being built for use on lines of different voltages. The single-pole type shown in the illustration presented here-

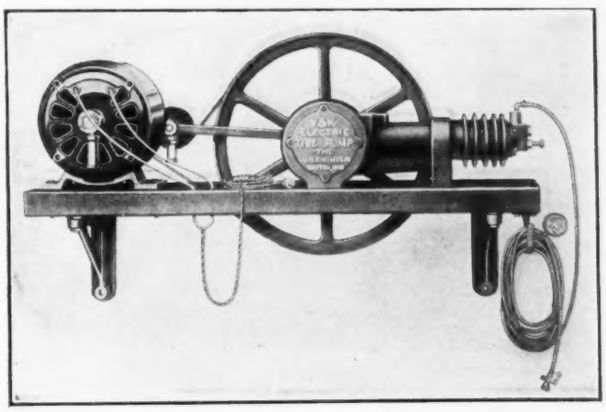


DISCONNECTING SWITCH FOR 30,000 VOLTS

with is designed for operation on a 30,000-volt, 150-amp circuit. The switches are also made for operation on 22,000 volts and 15,000 volts at 100 amp, with either one, two, three or four poles arranged for single or double break.

Motor-Driven Tire Pump

The Vaile-Kimeo Company, Dayton, Ohio, has recently placed on the market a new type of motor-operated tire



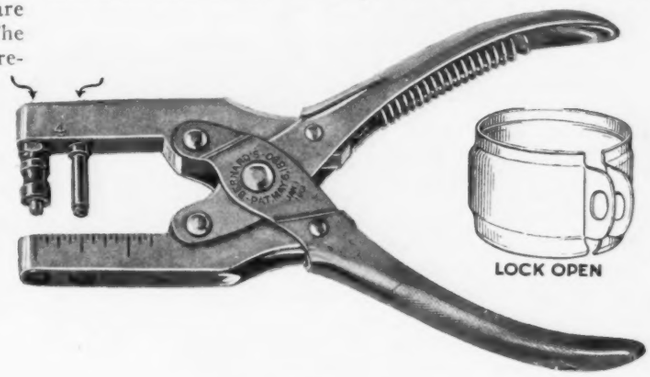
ELECTRICALLY DRIVEN FIRE PUMP

pump for use in private garages. The outfit is light and compact and is designed for mounting on the wall, entirely out of the way. The cost of operation is insignificant, since, at ordinary rates for electricity, it is said it will operate for less than 1 cent an hour.

The operating parts of the pump are inclosed in an oil-tight, dust-proof casing, so that practically no attention is required. A pressure gage registering up to 150 lb. is provided as part of the outfit. The pump is operated by a small Westinghouse motor.

Lamp-Locking Device

A simple device that can readily be attached to any standard brass-shell socket or receptacle, which securely locks



SPECIAL TOOL AND LOCK

the lamp and which cannot be removed without a special tool, has been placed on the market by Mr. Frederick Rall, 19 Park Place, New York City. To attach the so-called E-L Mazda lamp locks, the open lock shown above is slipped over the base of the lamp and the latter is screwed into the socket, the eyelet being inserted in the holes in the flange and clinched by means of the tool shown. To remove the lamp the plunger part of the tool is inserted in the eyelet and the latter forced out.

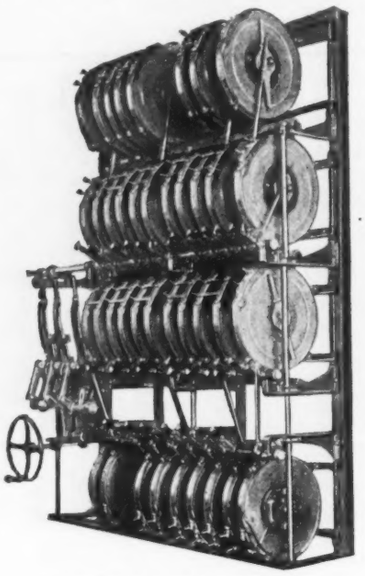
The locks are made in one piece, are insulated with heavy fiber washers and are said to be practically indestructible. They are made for all sizes of lamps and for use with or without shade holders.

Dimmer in Grand Opera Theater, Chicago

The total rating of lamps controlled by the dimmer in the Grand Opera Theater of Chicago amounts to 105,400 watts, the equivalent of 2655 40-watt or 4216 25-watt tungsten lamps. Duplex plates having nearly double the number of steps of the regular simplicity plates are used on the dimmer shown in the illustration. This type of plate made it possible to meet the peculiar requirements of the installation and provide the large number of steps needed to secure very fine gradations of light and smooth uniform dimming effects. It was desired to operate this dimmer bank in connection with a two-wire 110-volt system for a period of several months, but it also was specified that the same bank should be capable of being used in connection with a three-wire system to be installed later. The new style of plate can be made with entirely independent windings on each side so that it was possible to lay out the dimmer bank for either a two-wire or a three-wire circuit without increasing the number of plates. The con-

tact levers, riding over the two separate sets of contact buttons, can be arranged to operate independently, each under the control of a separate operating lever or in unison under the control of one operating lever.

Three rows of operating levers are provided, one for the white, one for the red and one for the blue light dimmer, and each row of levers is under the control of a master



VIEW OF THE DIMMER

lever. These levers are located side by side at the left of the bank, making operation very convenient. By means of the special link motion connecting a hand wheel with the master lever, extreme refinements in control are obtainable. Any one row or group of dimmers in that row can be operated in one direction to dim or brighten the lamps, while one or both of the other rows are operated in the opposite direction. This control is secured by means of the hand wheel alone, making very realistic stage-lighting effects possible. The equipment was installed by the Cutler-Hammer Manufacturing Company of Milwaukee.

Twelve-Pole, 1000-Kw, 60-Cycle Rotary Converters

Typical of the successful and reliable operation of 60-cycle rotary converters embodying modern departures in design for non-commutating-pole machines of this frequency are two 1000-kw units installed in Substation No. 1 of the Housatonic Power Company at Waterbury, Conn., for the supply of energy for railway service. Former standard practice for rotary converters of this rating and frequency involved the construction of machines having twenty poles and operating at a speed of 360 r.p.m., but through refinement of design later machines have been developed with twelve poles and operate at a speed of 600 r.p.m.

These 1000-kw rotary converters are six-phase machines and operate in parallel with four 500-kw, 60-cycle, six-phase converters previously installed in the same station, all of the apparatus being of the General Electric Company manufacture. Three-phase current at a potential of 33,000 volts is received from the main power station of the Housatonic Power Company and transformed by six 350-kva oil-cooled transformers to 430 volts. The rotaries are started from the alternating-current side only and deliver direct current at 600 volts. The transformers have two 2.5-per cent full-load taps below and above 33,000 volts in the primary and one-third and two-thirds voltage starting taps in the secondary. They are designed with 15 per cent inherent reactance. The rotaries are compound-wound and are built for standard carrying capacities of 150 per cent load for two hours or 200 per cent load momentarily.

The armature winding is made up of formed bars, which are insulated before being assembled in the slots. No binding bands are placed over the core, the winding being retained by wooden wedges. Any unbalancing in the mag-

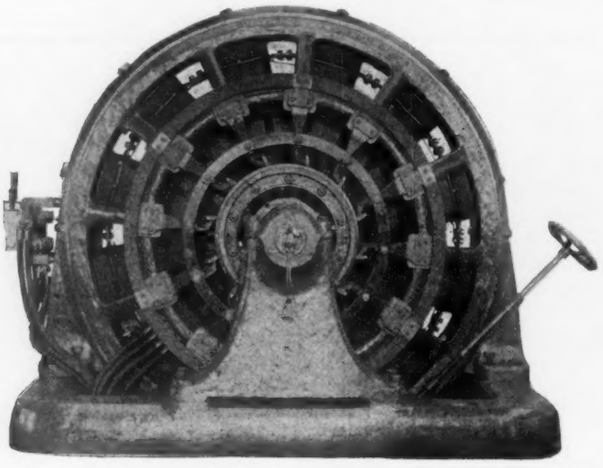


FIG. 1—1000-KW TWELVE-POLE ROTARY CONVERTER IN SUBSTATION OF HOUSATONIC POWER COMPANY

netic circuits is corrected by equalizer rings, mounted on the armature flange at the collector ring end. They cause the direct-current brushes to take their proper proportion of current, thus helping to keep the commutator in good condition and to prevent "spotting."

The brushes and brush-holders on the direct-current end of these machines are similar to those on other types of large direct-current apparatus. They are arranged so that they can be adjusted individually or collectively while the machine is in operation. Those employed on the collector rings are of improved design. So-called "Metite" brushes are used, made by combining fine copper and graphite with suitable binders.

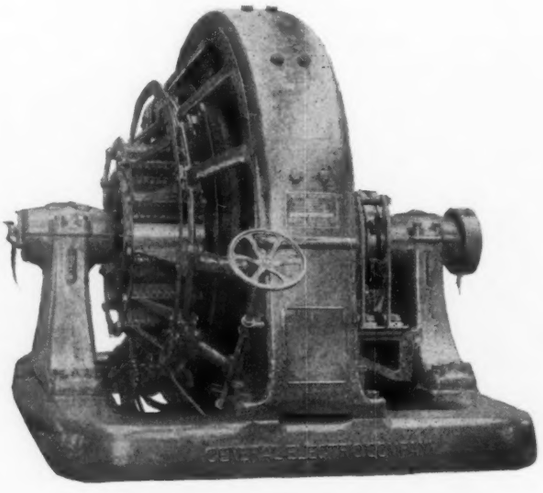


FIG. 2—DIRECT-CURRENT END OF CONVERTER

The machines are equipped with automatic magnetic end-play devices, which give a slight reciprocating motion to the armature in a direction parallel to the shaft and thereby cause the brushes to wear the commutator and collector rings more uniformly. Energy for the operation of the device is obtained from the direct-current side of the rotary converter. A condenser is connected across the

make-and-break to facilitate the opening and closing of the circuit.

For safe operation these converters are also equipped with speed-limiting devices for opening the circuit automatically in case the speed becomes too high. The device consists of a switch operated by a centrifugal governor. The centrifugal weight is mounted on the shaft and revolves with it, while the switch is stationary and is mounted on the collector-end pillow block. This weight is so designed that it operates at practically the same speed irrespective of the acceleration. The switch can be adjusted to operate at any predetermined speed, and is arranged to de-energize the low-voltage release coil on the direct-current circuit-breaker and open the circuit.

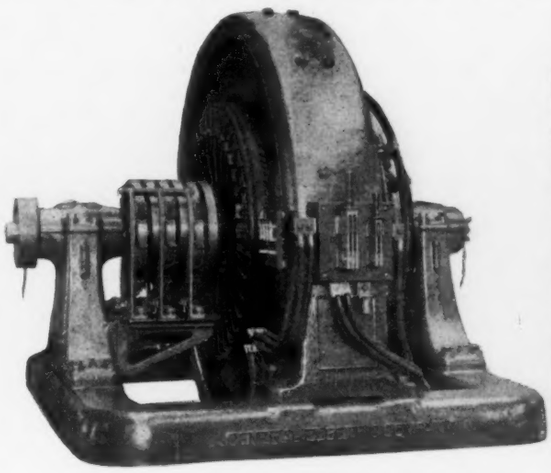


FIG. 3—ALTERNATING-CURRENT END OF ROTARY

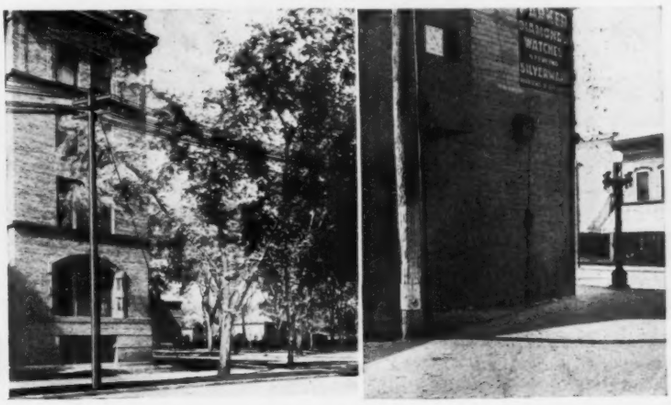
On the side of the frame is mounted a four-pole, double-throw, field-circuit break-up switch for the shunt-field coils. This opens up the field circuit in several places to reduce the strain on the insulation caused by the high potential induced in the coils during alternating-current starting and also provides a means of obtaining the proper polarity. The normal operating position of the switch is up, while the down position is used for reversing the polarity of the machine when it builds up magnetism in the wrong direction during alternating-current starting. A single-pole, single-throw equalizer switch and a double-pole, single-throw negative switch are also mounted on the magnet frame. Alternating current is applied directly to the armature winding at a reduced voltage obtained from the one-third and two-thirds voltage taps on the low-tension side of the transformers. After the machines have reached synchronous speed, the proper polarity has been obtained and the field-coils have been connected to the first starting tap, two-thirds and then normal voltage is applied.

Calculating Chart

An interesting time-saving device for arithmetic calculations is the circular chart devised and published by Mr. George M. Purver, 146 East Eighth Street, Brooklyn, N. Y. With a little practice, it is asserted, one can quickly find the product of multiplying a four-digit number by one of two digits, or extract the integer square root of an eight-digit number. Use of the chart avoids long multiplication and long division, and reduces considerably the work of squaring, cubing, finding squares and cube roots, determining areas and circumferences of circles, etc. Results are given correctly to all places, and with a facility equal to that of the slide rule, although the latter affords only approximate results. The chart is based on a polar-coordinate arrangement of factors.

Drive-and-Twist Anchors in Service

The use of drive-and-twist anchors made by the Vote Berger Company, of La Crosse, Wis., is illustrated herewith. These anchors are especially adapted for use in confined places and on lawns. In Fig. 1 it will be noticed that the anchor has been installed in the small space left between a building and the brick pavement in an alley. This space is not over 6 in. wide, and the anchor was driven in less than a minute without trouble. In such a position it would be difficult, perhaps, to install an anchor of any other type. To put in a "dead-man" would mean the tearing up of a part of the pavement at considerable expense.

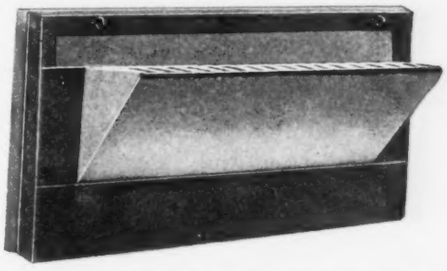


FIGS. 1 AND 2—DRIVE-AND-TWIST ANCHOR INSTALLATIONS

In Fig. 2 the drive-and-twist anchor is represented as installed in front of a public institution where the ground connections receive considerable care. To install a "dead-man" in this case would have involved some digging and an unsightly disturbance of the lawn. Disputes are often occasioned by the desire of electric-service and telephone companies to install anchors or "dead-men" on private property. The manufacturer of the drive-and-twist anchor contends that in cases where disputes are apt to occur the use of its device is often to be recommended because it does no damage, or only very slight damage, to the property.

Advertising Sign

An effective advertising sign with a varying color scheme has been placed on the market by the Foster Engineering Company, Ltd., Wimbledon, London. On the front plate are painted the words or other matter to be brought before the public, and behind this is a crinkled mirror set at an angle. Above the mirror and at right angles to the front plate is a glass cover coated with stripes of transparent colors. The light above, whether daylight or artificial, is reflected by the mirror onto the front plate. As a person passes by and the viewpoint changes the colors change accordingly, owing to the uneven surface of the mirror reflecting the light.



BACK VIEW SHOWING REFLECTOR AND COLORED TOP STRIP

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Annual Report of Siemens & Halske.—The report of Siemens & Halske, Berlin, for the year 1912 is a record of continued expansion in the application of electrical equipment for industrial and agricultural pursuits. Considerable growth was shown in the company's Russian business as well as in its German business. The year ended with 77,000 employees on the payrolls as compared with 66,000 at the end of the preceding year. The rapid growth of business at the Werner works necessitated increasing the manufacturing facilities. Automatic and semi-automatic telephones, the report says, are continually finding greater favor. During the year a loaded telephone cable was laid between Berlin and Magdeburg and this will probably be lengthened in the future. The company's lamp factory was very busy. There was also a growth in railway signaling equipment. The report of the Siemens-Schuckert works for 1912 states that orders were received much faster than the company's new factories could be placed in operation, making it very difficult to keep promises of delivery, and that further handicap was caused by inability to obtain raw materials. The company manufactured 134,539 motors during the year, with an aggregate rated output of 3,737,674 hp. Further increase was made in the ratings of transformers and other equipment. Speeds for prime movers were also increased. Steam turbo-generators rated at 6000 kva for operation at 3000 r.p.m. were among the products, as were waterwheel-type generators rated at 12,500 kva. Activity resulted from the increase in long-distance power transmission projects and electrification of railways. The company is increasing its office space at Berlin. As was noted in these columns in the issue for Jan. 11, 1913, the Siemens Company of Canada, representing the associated Siemens companies of Europe, has its head office in Montreal with branch offices in Toronto and Winnipeg. Since commencing operations in Canada three years ago, the company has carried out a large amount of important work for many of the principal cities and for a large number of private corporations in the Dominion, and its apparatus is distributed from Dawson City in the Yukon district to the large steel and coal companies in the eastern part of Canada. Among the work done by the company may be mentioned the installation of the complete equipment for the 6000-hp, 20,000-volt station at Port Arthur, Ont., where there are two banks, each consisting of three 750-kw, 22,000-volt transformers, an eighteen-panel switchboard, lightning arresters and two 750-hp motor-generator sets, the second bank of transformers, part of the switch gear and one of the motor-generator sets being repeat orders after the first part of the plant had been in successful operation for eighteen months. Fifteen turbo-generators have either been supplied or are on order, the largest being a 5000-kva machine for Edmonton, Alta. The city of Regina gave a repeat order for a 1500-kw turbo-unit after the first set had been in operation for nearly twelve months, together with a repeat order for a 400-kw street railway unit. Much important work as regards the furnishing of electric hoisting engines, a class of equipment which has been especially developed by the company for many years, has also been accomplished. These installations include electrically operated hoisting engines with maximum ratings as follows: One of 1430 hp and one of 750 hp for the Canadian Collieries Company; one of 1320 hp for the Dominion Coal Company, all on the Ward-Leonard system; two of 450 hp for the Arcadia Coal Company, for operation on the three-phase system, and one of 400 hp for the Dominion Coal Company, for operation on the Siemens-Ilgner system. Two of the foregoing are said to be the largest electrically operated hoisting engines on this side of the Atlantic. Another field which the company has successfully developed is that of lightning protection. The Ontario Hydro-Electric Commission originally installed arresters of the electrolytic type, but later placed orders for twenty sets of 13,000-volt Siemens arresters. The company has also supplied 12,000-volt, three-core cable to the Ontario Power Company and to the Ontario Hydro-Electric Commission, where the same has been in continuous operation for nearly three years.

Annual Sales Conference of Pass & Seymour, Inc.—With B. E. Salisbury, vice-president and general manager, presiding, the annual sales conference of Pass & Seymour, Inc., manufacturers of electrical specialties and supplies, was held Jan. 15 to 18 inclusive, at Solvay, N. Y., where the main office and works are located. Many interesting papers were read and discussed, and on the evening of Jan. 16 those in attendance at the conference were guests of Mr. Salisbury at dinner at his home, followed by a theater party. The sentiment of all of the company representatives at the conference was extremely optimistic as regards the business outlook for 1913. Substantial increase was made in the company's business in 1912, and further improvement is expected in the current year. Among those who attended the conference were: L. John Bergman, credit manager; John W. Brooks, secretary and director of exports; F. S. Baldwin, district sales manager at New York; V. R. Despard, district sales manager at Chicago; W. Brewster Hall, district sales manager at San Francisco; Frank T. Haffner, Frank Driscoll and John D. Raymond, Chicago office; George L. Hatheway, C. C. Heeb and W. E. Gould, New York office, and James S. Crossley, general superintendent.

The Broader View of Advertising.—C. L. Benjamin, advertising manager for the Cutler-Hammer Manufacturing Company, is vice-president of the Advertisers' Club of Milwaukee, and on the occasion of a recent dinner in that city given in honor of George W. Coleman, president of the Associated Advertising Clubs of America, Mr. Benjamin was toastmaster. At that time he gave some of his views on the broader aspects of advertising. He showed how the attitude of the business man toward advertising has changed during the last twenty years, and among other things he said: "We don't look on advertising now as a sop to the newspaper or trade-paper publisher. We don't look on it as a gamble. We know now that it is an investment—that the money spent in popularizing a trade name is as tangible an investment as the money spent for real estate, factory buildings or machinery." Further on Mr. Benjamin added: "The advertising man is progressing because he is taking a higher view of his own work. I believe, as the years go on, he will take a still higher view. The work we are engaged in is a worthy work. It is the work of molding the opinions of our fellow-men."

Bankruptcy Petition Against Iowa Power Company.—A bankruptcy petition against the Iowa Power Company, operating water-power plants along the Skunk River in southern Iowa, was filed on Jan. 20 in the United States District Court in Chicago on behalf of the Western Electric Company and another creditor. It is said that in addition to insolvency the bill alleged that preferential payments were made to certain creditors. The petitioning creditors' claims amount to about $7,000, and the total liabilities are given as $10,000.

Planning to Merge La Crosse (Wis.) Utility Companies.—It is understood that the protective committee acting for the bondholders of the La Crosse (Wis.) Water Power Company has exercised the option which it has had on the property of the La Crosse City Railway Company, and that plans that have been under consideration for some time to merge these two utility companies and the Winona (Minn.) Railway & Light Company will now be consummated.

Operations of New York Lighting Companies in 1912.—For the year ended Dec. 31, 1912, the Consolidated Gas Company of New York, which controls, in addition to its gas subsidiaries, the New York Edison Company, the United Electric Light & Power Company and the Westchester Lighting Company, earned a surplus of $1,536,699, which is a decrease of $26,188 as compared with that for 1911. This was after payment of $5,988,990 in a 6 per cent dividend on the $99,816,500 capital stock and of $479,430 in fixed charges. Total net earnings available for dividends, as shown in the 1912 report, which was submitted by President George B. Cortelyou at the annual meeting on Jan. 27, 1913, including the net returns of the company's gas business, the surplus earnings of the Astoria Light, Heat & Power Company, dividends and interest received on stock and bonds owned, together with advances made to affiliated gas and electric companies operating in the boroughs of Manhattan, Queens and the Bronx and Westchester County, and after deduction of $479,435 interest on funded and other debt, were $7,525,689, which is equivalent to 7.53 per cent on the company's capital stock and compares with 7.56 per cent in 1911. Of the New York Edison Company, the report says that during the year 1912 there were added to the generating stations of that company fifty-six automatic stokers, twenty superheaters, centrifugal boiler-feed pumps and new feed-water heaters, and that the installation of three 20,000-kw turbines was completed. Rotary converter equipment to the extent of 20,000 kw, together with 8650 kw in storage batteries, was added to substations on the direct-current system. On the alternating-current system 4000 kw was added to the substation transformers and 12,000 kw in 16,000-volt, 60-cycle transformers. Reference is also made to the twenty-one-year agreement made with the Third Avenue Railway Company, New York, through which the New York Edison Company has undertaken the operation of the former's 30,000-kw station at Kingsbridge and is supplying all of the electrical energy required by the railway company. A reference to this contract appeared in the *Electrical World* for Aug. 3, 1912, page 231. The report also speaks of the progress that is being made in the construction of the West 201st Street plant of the United Electric Light & Power Company, of which mention was made in these columns Feb. 3, 1912. The equipment thus far contracted for includes three 19,000-kva turbo-generator units. An estimate covering the completion of the building and equipment for its ultimate output indicates a total cost of about $6,200,000 for the station. It is expected that the setting of the boilers will be started early in February and that the station will be ready to be placed in operation with at least two of the units early in the fall of this year.

Says Close Affiliation of Chicago Elevateds Favors Economical Operation.—On May 20, 1912, the City Council of Chicago passed an ordinance directing the elevated railway companies to give universal transfers from one elevated railway line to another. The companies denied the right of the city to exact this requirement and the matter was taken into court. Judge Baldwin has now decided that the position of the elevated-railway people is well founded and has entered a permanent injunction against the enforcement of the ordinance. The court held that the city has no statutory right to fix rates for steam and elevated railroads. It is probable that the city will take an appeal to the Supreme Court. The judge found that the companies were incorporated under the general railway act and that the Legislature had not delegated to the City Council the power to regulate rates. He did, however, find for the city on the contention that the properties are practically owned and operated by one syndicate. On this point, relating to the interesting situation created by the "association" which controls the elevated railways, Judge Baldwin said: "Four persons—Insull, Blair, Budd and Cobe—are directors in all three companies [South Side, Metropolitan West Side and Northwestern], and the relations which these men, with others, bear to the enterprise, as disclosed by the testimony in this case, leaves little doubt that they dominate the situation, and that the properties are practically owned, operated, managed and controlled by the same persons, syndicate, managing trustee or trustees, committee or association, within the meaning of the ordinance. It is easy to see that such an arrangement tends to economical management and reduces appreciably the expense of operating the properties nominally owned by these three companies."

Cedar Rapids Manufacturing & Power Output Contracted For.—Stockholders of the Montreal Light, Heat & Power Company and the Shawinigan Water & Power Company of record Feb. 20 are to have the right to subscribe until 3 p. m. March 20 for $8,400,000 first-mortgage 5 per cent forty-year bonds of the Cedar Rapids Manufacturing & Power Company, of Montreal. These bonds are part of the new issue of $15,000,000 recently authorized by the stockholders of the Cedar Rapids company, to which reference was made in these columns Jan. 11. They are offered to the Montreal and Shawinigan stockholders at 90, with a bonus of 25 per cent common stock, in the proportion of 30 per cent of their holdings in their respective companies. According to the circular describing the offering, contracts have been made by the Cedar Rapids company with the Aluminum Company of America and the Montreal Light, Heat & Power Company for the delivery of 80,000 hp of a total of 120,000 hp already under contract, to be generated at the hydroelectric station of the Cedar Rapids company now under construction on the St. Lawrence River, about 30 miles from Montreal. These contracts will not only provide the interest on the full issue of bonds now offered, but will also furnish a substantial surplus applicable for dividends on the common stock. These results, it is stated, will be substantially increased later by sale of additional energy from the initial development and by the sale of 50,000 hp of electrical energy to be generated at the second development.

Revive Philadelphia Electric-United Gas Improvement Merger Rumor.—It is stated that after the meeting of the directors of the Philadelphia Electric Company on Jan. 28 members of the board said that while a proposal to merge with the United Gas Improvement Company had not come before the board, it would be received eventually and would have careful consideration. It is further stated that this proposal is expected within a month and that it will probably come before the Philadelphia Electric board at the February meeting if a special meeting is not called before that time. At the directors' meeting the installation of a 30,000-kw generating set at the company's main station was authorized, together with the erection of a 7500-kw unit at the Tacony plant.

Extends Time for Depositing Allis-Chalmers Securities.—The reorganization committee for the Allis-Chalmers Company announced this week that it would receive additional first-mortgage bonds for deposit until noon Feb. 3 1913. Deposits of preferred and common stock with accrued assessments will also be received until that time. Upon purchase by the reorganization committee of the mortgaged property at the foreclosure sale that is to be held Feb. 3, a voting trust of the new preferred and common stock will be created for a term of five years. The following have been appointed voting trustees: James N. Wallace, Charles G. Dawes, Alexander J. Hemphill, W. Emlen Roosevelt and Henry F. Whitcomb.

Nine Companies Organized in Pennsylvania.—With H. M. Smith, of Brooklyn, N. Y., named as treasurer in each case, and F. V. Shannon, New York; R. A. Lankworthy, Easton, Pa., and H. M. Smith, of Brooklyn, as directors, nine electric service companies have been incorporated at Harrisburg. The names of the new concerns are: Huron Power Company, Iroquois Power Company, Mohican Power Company, Onondaga Power Company, Powhatan Power Company, Secaucus Power Company, Seminole Power Company, Seneca Power Company and Tecumseh Power Company.

Gas Engines for Hotel Service.—The Bruce-Macbeth Engine Company has just completed the installation of three 150-hp gas engines for the Fort Pitt Hotel, Pittsburgh. Each engine is direct-connected to a 100-kw, three-wire generator. These sets will be operated in parallel with steam units already installed. The engines are equipped with double magneto igniters and gas economy indicators which show the rate at which gas is being consumed per kilowatt-hour by each engine.

New Canadian Company Incorporated.—According to advices from Ottawa, the Dominion Traction & Lighting Company has been incorporated with a capital stock of $12,500,000 to develop and sell electrical energy and gas.

Kentucky Company Plans Extensions.—Early in the spring the Kentucky Southwestern Railway & Light Company will begin construction of its initial line from Paducah, Ky., southwest to Murray, about 40 miles distant. The plans of the company include construction of a number of electric-service systems for both railway and lighting purposes in the southwestern part of the State, aggregating about 210 miles. H. C. Rhodes, of Paducah, is president of the company, and F. M. Smith, of the same city, is general manager. Bonds to the amount of about $1,500,000 are to be issued shortly by the company, it is said.

Boston Edison Stock Quotations.—In our issue of Jan. 11, in the Table of "Electric Securities," we stated through a typographical error that the capital stock of the Edison Electric Illuminating Company of Boston was quoted at 239 and that the quarterly dividend rate was 2½ per cent. It should have been stated that the quarterly dividend rate was 3 per cent and that the market price on the day that the table was made up was 284.

United Service Company Enlarges Its Holdings.—The New Midland Power & Traction Company, of Cambridge, Ohio, has been purchased by the United Service Company, of Scranton, Pa. Plans are being made to erect a transmission line to connect Cambridge, Coshocton and New Philadelphia, in which places the United Service Company controls the public utilities.

Diehl Manufacturing Company Acquires More Manufacturing Space.—Title to 12½ acres of property fronting on Newark Avenue, Elizabeth, N. J., has been taken by the Diehl Manufacturing Company, of Elizabethport. In the spring the company will proceed with construction of a second factory upon this site.

New England Power Increases Its Capital.—Stockholders of the New England Power Company, Shelburne Falls, Mass., have voted to increase the capitalization of the company from $1,500,000 to $3,250,000 through issuance of 6 per cent cumulative preferred stock.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Jan. 22	Jan. 29
Allis-Chalmers, t. r., 3d pd.	$15,501,800	.....	.....	3⅞	4⅛*
Allis-Chal., pf., t. r., 3d pd.	13,475,200	.....	.....	10*	9½*
Amalgamated Copper	153,887,900	1½	Q	75⅜	72½
American Tel. & Tel.	334,852,900	2	Q	133½*	133½
Electric Storage Battery, c.	16,074,425	1	Q	53	53½
General Electric	101,203,000	2	Q	142½	142½
Mackay Cos., c.	41,380,400	1½	Q	85*	84½*
Mackay Cos., pf.	50,000,000	1	Q	67½*	67½*
Western Union Tel.	99,745,400	¾	Q	71¼	72*
Westinghouse, E. & M., c.	33,737,350	1	Q	74¼	74½*
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	121¼*	119½*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	Jan. 21 Bid.	Jan. 21 Asked.	Jan. 28 Bid.	Jan. 28 Asked.
Copper:				
Standard spot	15.25	.....	15.50	.....
	£ s d		£ s d	
London, standard, spot	68 17 6		68 12 6	
Prime Lake	16.25		16.37½	
Electrolytic	16.00		16.25 to 16.35	
Casting	15.87½		16.05 to 16.15	
Copper wire, base	18.00 to 18.25		18.00 to 18.25	
Lead	4.35		4.35	
Nickel	45.00		40.00 to 45.00	
Sheet zinc, f.o.b smelter	9.00		9.00	
Spelter, spot	7.25		7.00	
Tin, spot	50.00		50.75	
Aluminum:				
Prompt delivery	25.75 to 26.25		26.00 to 26.50	
Future	25.50 to 26.00		26.00 to 26.50	

OLD METALS

Heavy copper and wire	14.25	14.25
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN JANUARY

Total tons to	Jan. 22, 16,483	Jan. 29, 21,050

Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding	DIVIDEND		LAST QUOTATION	
		Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	$9,500,000	.....	.....	19	21
Adirondack Elec. Power, pf.	2,500,000	.....	.....	59	61
Amer. Gas & Electric ($50), c.	2,500,000	1¾	Q	82	85
Amer. Gas & Electric ($50), pf.	1,537,500	1¾	Q	44½	46½
Amer. Light & Traction, c.	10,395,400	2½	Q	405	415
Amer. Light & Traction, pf.	14,236,200	2½	Q	108	111
Amer. Power & Light, c.	5,631,400	.....	.....	63	67
Amer. Pwr. & Lt., 6% cum. pf.	5,631,400	1½	Q	83½	85
Amer. Pwr. & Lt., opt. warr.	1,604,000	.....	.....	13	15
Amer. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	98	100
Appalachian Power, c.	6,000,000	.....	.....	23	24
Appalachian Power, pf.	2,180,000	.....	.....	73	74½
Arizona Power, c.	3,000,000	.....	.....	12	13
Arizona Power, pf.	850,000	.....	.....	50	55
Asheville Light & Power, 1st s. f. 5s, '42	1,100,000	2½	S	93	96
Augusta-Aiken Railway & Electric, s. f. 5s, '35	2,588,000	2½	S	90	94
Augusta-Aiken Ry. & Elec., c.	2,250,000	.....	.....	23	25
Augusta-Aiken Ry. & Elec., pf.	1,500,000	1½	Q	75	85
Augusta Railway & Electric, 1st 5s, '40	967,000	2½	S	101	103
Central Maine Power, 1st 5s	2,502,000	2½	S	97	99
Cities Service, c.	5,499,430	½	M	119	122
Cities Service, pf.	10,195,360	½	M	87½	89½
Columbus Railway Gas & Electric, 1st 5s, '36	2,454,000	2½	S	93	95
Columbus Ry., G. & Elec., c.	2,000,000	.....	.....	60	....
Columbus Ry., G. & Elec., pf.	840,000	1½	Q	85	95
Commonwealth Edison, cap. stock	32,964,800	7	A	142½	....
Consolidated Gas, Electric & Power (Baltimore), 4½s	11,564,000	2¼	S	90	90½
Consum. Pwr. (Mich.), 5s, '36	10,088,000	2½	S	95½	97½
Consumers Power (Minn.), 1st 5s, '29	9,528,000	2½	S	89	92
Dallas Elec. Corp., 5s, '22	3,659,000	2½	S	95½	97½
Denver Gas & El. Lt., c.	7,001,300	½	M	220	....
Denver Gas & El. Lt., gen. 5s.	6,000,300	2½	S	93	95
Edison El. Ill. of Boston, cap. stock	15,603,700	3	Q	280	....
Empire District Electric, 5s	1,925,000	2½	S	84	88
Federal Light & Traction, c.	4,750,000	.....	.....	30	33
Federal Light & Traction, pf.	2,500,000	1½	Q	80	83
Gas & Electric Securities, c.	1,000,000	.....	.....	125	135
Gas & Electric Securities, pf.	1,000,000	7	A	92	96
Harwood Electric, 5s, '39	1,000,000	2½	S	100½	102½
Lincoln Gas & Electric, c.	2,250,000	.....	.....	27	31
Lincoln Gas & Electric, 5s, '41	796,000	2½	S	87	90
Niagara Falls Power, 5s, '32	10,000,000	2½	S	101⅜	102⅛
Northern States Power, c.	5,975,000	.....	.....	24	25
Northern States Power, pf.	8,386,700	1¾	Q	84½	86
Pacific Gas & Electric, c.	31,908,750	1½	Q	62	62½
Pacific Gas & Electric, pf.	10,000,000	1½	Q	91½	92
Philadelphia Electric ($25)	24,987,750	1½	Q	24⅜	....
Portland General Electric, 5s	8,000,000	2½	S	100	102
Republic Railway & Light, c.	5,200,000	.....	.....	24	26
Republic Railway & Light, pf.	6,360,000	1½	Q	78	80
St. Joseph's R., L., H. & P., 5s	4,637,000	2½	S	99	99½
Seattle Electric Co., con. 5s, '29	7,417,000	2½	S	98	100
Southern Calif. Edison, 5s, '39	10,043,000	2½	S	96	98
Southern Power, 5s	4,000,000	2½	S	99½	101
Standard Gas & Elec. ($50), c.	9,343,150	.....	.....	21½	22
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	49½	51
Tennessee R., L. & Pwr., c.	20,000,000	.....	.....	22½	24½
Tennessee R., L. & Pwr., pf.	10,250,000	1½	Q	77¼	78
Tri-City Railway & Light, c.	9,000,000	.....	.....	56	60
Tri-City Railway & Light, pf.	2,826,200	1½	Q	93	95
Tri-City Ry. & Lt., 5s, '23	8,207,000	2½	S	97	98
Virginia Railway & Power, 5s	10,345,000	2½	S	94	96
Western Power	14,670,000	.....	.....	....	23
Western Power, 6% cum. pf.	6,000,000	6	A	....	50
Western States Gas & El., c.	3,503,000	.....	.....	53	59
Western States Gas & El., pf.	1,800,000	1¾	Q	93	98
Western States Gas & El., 1st and ref. 5s, '41	3,400,000	2½	S	92½	95

Personal

Mr. E. J. H. Thiemer, electrical contractor of Brooklyn, has been re-elected president of the Electrical Contractors' Association of Long Island.

Prof. Daniel W. Mead, of the University of Wisconsin, Madison, has been appointed a member of the N. E. L. A. committee on prime movers.

Mr. S. Tupper has been placed in charge of the plant of the Salem Electric Light Company at North Salem, Mass., succeeding the late H. S. Woodbury.

Mr. G. Wilbur Hubley, chief engineer of the Louisville (Ky.) Lighting Company, was recently elected a member of the directorate of the Louisville Engineers and Architects' Club.

Dr. Edward G. Acheson, the inventor of carborundum and deflocculated graphite, has been made an honorary member of the Imperial Technological Society of Russia. He delivered a lecture before the society at St. Petersburg Jan. 22.

Mr. E. B. Korst, until recently manager of the new-business department of the Ottumwa Railway & Light Company, Ottumwa, Ia., has resigned to accept a position as district superintendent of the Central Illinois Public Service Company of Matttoon, Ill.

Mr. D. C. Greene, of Marshfield, Ore., manager of the Oregon Power Company and also president of the Marshfield Chamber of Commerce, represented the latter body at Washington recently in an effort to secure an additional appropriation for the improvement of Coos Bay Harbor.

Mr. L. R. MacBroom, who for four years was a general superintendent for the Rutland (Vt.) Railway, Light & Power Company and more recently connected with the General Electric Company at Birmingham, Ala., has been made superintendent of the municipal electric light plant at Burlington, Vt.

Mr. John W. Lieb, Jr., vice-president of the New York Edison Company, has accepted reappointment as chairman of the street-lighting committee of the National Electric Light Association. He has already organized his committee with the following members: Dr. C. P. Steinmetz, Dr. Louis Bell, Prof. A. F. Ganz and Mr. Preston S. Millar.

Mr. Van Dusen Rickert, general manager of the Eastern Pennsylvania Light, Heat & Power Company, of Pottsville, Pa., and president of the Pennsylvania Electric Association, addressed the members of the Metropolitan Electric Company Section, N. E. L. A., Reading, Pa., on Jan. 15, on the subject of welfare work and central-station practice.

Mr. R. C. Dwyer, district manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, has been transferred to the engineering department of the company at Boise. He is succeeded by Mr. B. H. Wayne, formerly connected with the Nampa office of the company. Mr. J. D. Orr, local manager of the Nampa office, will have general supervision of both the Caldwell and Nampa systems.

Mr. Alton M. Frost has resigned from the engineering department of the Crocker-Wheeler Company to accept a position with the General Electric Company at Harrison, N. J. He will be connected with the Moore light department of the development laboratory. Prior to his connection with the Crocker-Wheeler Company Mr. Frost was an engineer with the Moore Light Company, of Newark, N. J.

Mr. G. H. Caffrey, formerly superintendent of the Norwalk (Conn.) district of the United Electric Light & Water Company, has accepted the position of engineer of the Havana (Cuba) Railways & Light Company. Mr. Caffrey is a graduate of the Stevens Institute of Technology and was connected with the engineering department of the New York & Hudson River Central Railroad Company before going to Norwalk. His successor at Norwalk will not be Mr. G. F. Atwater, as stated in the Jan. 18 number; but Mr. F. H. Wade. Mr. Atwater will remain in charge of the Greenwich division of the United Electric Light & Water Company.

Mr. A. C. Linzee, formerly president and chief engineer of the Imperial Electric Company, Akron, Ohio, has resigned to engage in consulting engineering. Mr. Linzee was with the General Electric Company as designing engineer and went from that company to the Akron Electrical Manufacturing Company. When the latter company was reorganized four years ago as the Imperial Electric Company he was made president and superintendent. Mr. Linzee was one of the first to bring out a strictly intermittent-service elevator motor, which permitted his company to put on the market a low-cost elevator motor with high commutating capacity and starting torque. He is also the designer of the present line of interpole, ventilated commercial motors and interpole elevator motors manufactured by the company with which he was formerly connected.

Mr. C. G. Baird, formerly manager of telegraphs and telephones of the Pennsylvania Railroad in New York City, has been promoted to the position of division operator of the Manhattan division, with headquarters in the new Pennsylvania station. Mr. Baird first entered the service of the Pennsylvania Railroad on March 9, 1893, as messenger at Philadelphia. On May 21, 1894, he was made extra telegrapher, a position he held for seven years. He severed his connection with the Pennsylvania Railroad on Sept. 25, 1901, to enlist in the Signal Corps of the United States Army, and was honorably discharged as a first-class sergeant on Sept. 23, 1904. The following year he re-entered the employ of the Pennsylvania Railroad and filled several important positions at the general offices in Philadelphia until he was transferred to New York on March 1, 1910, to supervise the installation of the extensive telephone and telegraph systems at the Pennsylvania station.

Mr. Sigmund Bergmann, formerly at the head of the Bergmann Electricity Works, of Berlin, Germany, which during the last year was absorbed by the Siemens-Schuckert company, is at present on a visit to this country. Mr. Bergmann came to this country for the first time in 1870 and was subsequently associated for several years with Mr. Thomas A. Edison. In 1892 he organized the New York Electric Equipment Company, becoming president and principal owner of this concern. This interest, however, he soon sold out to return to Germany, where he established the concern bearing his name, which for nearly twenty years held a prominent place in the electrical industries of Europe. Mr. Bergmann is credited with many achievements in connection with the early developments of electrical machinery, the incandescent lamp, storage batteries and telephone and telegraph apparatus.

Mr. Fred W. Abbot, who was in successful charge of the large construction operations of the Electric Bond & Share Company's interests prior to Oct. 15, 1912, has been placed in charge of Dr. F. S. Pearson's extensive operations in and around Barcelona, Spain, which involve the construction of six hydroelectric plants, high-voltage transmission systems and large irrigation works. It is understood that Mr. Abbot now has about 7000 men on the work in Spain and expects to have a force of 12,000 by June 1. In the last four years Mr. Abbot has carried to successful completion four hydroelectric generating stations, which in most cases involved high-voltage transmission systems. These were the Central Colorado Power Company's Shoshone and Boulder generating stations and high-voltage transmission system; a hydroelectric plant at Bonny Eagle, Maine; the Blewett Falls (N. C.) plant of the Yadkin River Power Company, involving the construction of 130 miles of 100,000-volt transmission lines, and a hydroelectric plant in Alabama, together with additions of 30 miles of 110,000-volt steel-tower transmission line and also a number of 60,000-volt lines in North Carolina.

Mr. George L. Knight, head of the engineering department of the Edison Electric Illuminating Company of Brooklyn, was recently elected a member of the board of directors of the Brooklyn Engineers' Club. Mr. Knight was born in Haddonfield, N. J., Feb. 20, 1878, and was graduated from Drexel Institute, Philadelphia, in 1900. He began his career in the electrical world as a switchboard operator for the Philadelphia Electric Company and afterward became wireman for the D'Olier Engineering Company. In 1902 Mr. Knight entered the equipment department of the New York Navy Yard as an electrical draftsman, and in the following year he became mechanical draftsman and surveyor for the New York Edison Company,

where he was engaged in laying out boilers, piping, coal-handling machinery, blowers, etc., for additions to the Waterside station, as well as turbine foundations, including the layouts for the auxiliaries. As chief draftsman of the New York Edison Company's Waterside station in 1903-05 Mr. Knight was in charge of the mechanical and civil engineering design for the completion of the station and the installation of apparatus, etc. He entered the service of the Brooklyn Edison company as chief draftsman in 1905 and in 1907 became the designing engineer for that corporation. His work there covers all electrical, mechanical and civil engineering design, and he is also superintendent of building construction. Mr. Knight is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the New York Electrical Society, the National Electric Light Association and for the past three years he has served as a member of the committee on electrical apparatus appointed by the last-named organization.

Mr. Frank F. Fowle has severed his connection with the McGraw Publishing Company as one of the editors of the *Electrical World*, and has resumed his electrical engineering practice with offices at 68 Maiden Lane, New York City. From 1899, when Mr. Fowle was graduated from the Massachusetts Institute of Technology with the degree of electrical engineer, up to 1908, he was connected with the American Telephone & Telegraph Company. He served in the engineering department in New York from 1899 to 1903, and in the railway department from 1903 to 1906. From 1906 to 1908 he was with the operating department of the American Telephone & Telegraph Company as manager of the Chicago territory of the long-distance department. Mr. Fowle was engaged in consulting engineering work in Chicago from 1908 to 1912, during which time he was appraisal and rate expert for the city of Beloit, Wis., in connection with the Beloit case heard before the Wisconsin Railroad Commission, examined St. Paul water mains to determine the extent of damage from electrolysis, appraised telephone property, investigated isolated-plant economy, gave expert testimony, made extended investigations into the properties and economic uses of copper-clad steel wire, and advised in reference to rates and standards for street lighting. He also made miscellaneous practical investigations and reports for public service corporations, railroads, manufacturers and municipalities. Mr. Fowle has contributed about fifty technical papers and articles to engineering societies and publications. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the National Electric Light Association, the Railway Signal Association and the Technology Club of New York. Mr. Fowle is a member of the telegraphy and telephony committee and of the patent committee of the A. I. E. E.

Mr. S. R. Inch, whose appointment as general superintendent of the Utah Power & Light Company, Salt Lake City, Utah, was noted in the *Electrical World* of Dec. 21, 1912, was apprenticed in accordance with the English system to the Electricity Supply Works, Taunton, England, and received his technical education at Finsbury Technical College, London. He was for a time associated with the Lithanode Electric Storage Battery Company of London, but in 1900 he entered the employ of the Montana Power Transmission Company. Later he was associated with the Butte (Mont.) Electric & Power Company and in 1904 accepted the position of manager of the Missoula (Mont.) Light & Power Company. Various extensions and consolidations have built up these properties to include the Clark-Missoula Power Company, the Missoula Light & Water Company and the Missoula Street Railway, and it was the management of these combined properties that Mr. Inch relinquished in order to take up his present position. He was the originator of the Missoula one-man prepayment car and read a paper on its operation before the Chicago convention of the American Electric Railway Association last October. Mr. Inch was associated with the Missoula properties, which are owned by former United States Senator W. A. Clark, for nearly ten years, and the company with which he is now connected is a consolidation of a number of companies which operate in Utah, Idaho and Colorado, the most important of which is the Telluride Power Company. The properties have about 1000 miles of high-tension transmission lines and develop more than 100,000 hp. Water-power resources sufficient to yield 100,000 hp additional are owned by the combination, which will furnish energy for the operation of the mountain section of the Denver & Rio Grande Railroad, plans for the electrification of which were referred to recently in the *Electrical World*.

Mr. Samuel Macaw Kennedy, who contributes frequently to electrical periodicals on matters relating to rate making, business building and public policy, was born in Toronto, Can., June 20, 1864, and was educated in the Model School, Collegiate Institute and Upper Canada College, in that city. After leaving college he entered his father's business and began studying the problems of "buying in the cheapest market and selling in the dearest" from the wholesale importer's standpoint. In due course he was appointed one of the firm's foreign buyers and for ten years made frequent trips to and from Europe, crossing the Atlantic forty-two times before he had completed his thirtieth year. During the latter portion of this period he had entire charge of the European end of the business and made regular visits to the manufacturing centers of Great Britain, France, Switzerland, Germany and Austria. Primarily as the result of a sunstroke his health broke down, and for five years he traveled in search of a congenial climate, eventually going to California, where he regained his strength. In 1901 he became identified with the electrical business as assistant to the president of the United Electric Gas & Power Company of Los Angeles, which company was absorbed in 1903 by the Southern California Edison Company. Since that date Mr. Kennedy has acted as general agent of the Edison company and has guided the commercial end of the corporation's growing business. He is also a director in and secretary of the Santa Barbara Gas & Electric Company and the Long Beach Consolidated Gas Company. Mr. Kennedy is an active worker in the National Electric Light Association and is also a member of the American Institute of Electrical Engineers, the Electric Vehicle Association of America and the Pacific Coast Gas Association.

SAMUEL M. KENNEDY.

Obituary

William J. Denver, for twenty-seven years assistant general manager of the New England Telephone & Telegraph Company, died recently at his home in Florence, Mass. He retired from active connection with the company in the summer of 1912 on account of failing health. Mr. Denver was born in Springfield, Mass., in 1841, and at the age of sixteen became a telegraph operator at Bellows Falls, Vt., later going to Northampton and New Haven and then to Springfield, where he became local manager of the Western Union Telegraph Company in 1864. In the late seventies the Bell Telephone Company sought to enter Springfield. Mr. Denver had held the rights of the company in Hampden and Hampshire Counties, but was compelled to release them because of conflicting interests with the Western Union organization. He persuaded the latter company to establish exchanges in Springfield, Boston, Providence and Worcester, and upon the sale of its telephone interests to the Bell company he resumed work in the telegraph field, continuing until 1885, when he became assistant general manager of the New England company. He was affiliated with many social organizations, belonged to the Telephone Pioneers of America and was a past-president of the Telephone Employees' Association.

Construction

GADSDEN, ALA.—The Alabama Pwr. Co. is preparing to extend its transmission line across Sand Mountain to Guntersville, Huntsville and Decatur.

TEMPE, ARIZ.—The reclamation service has announced the erection of a transmission line to tap the Water Users' transmission line from the Arizona Falls plant at the cross-cut plant. The work will include the erection of a span power line 1625 ft. long, suspended on towers from 75 ft. to 90 ft. high, from the town of Tempe across the Salt River, just above the new bridge to tap the line from the Arizona Falls near the new cross-cut power house.

SEARCY, ARK.—U. S. Bratton, of Little Rock, and associates have submitted a proposition to the City Council offering to purchase the municipal electric-light plant. They ask for a 25-year franchise and propose only to pay the outstanding indebtedness and accrued interest. It is proposed to operate the plant by electricity generated at the proposed hydroelectric power plant, to be located on the Red River above Searcy.

SPRINGDALE, ARK.—The City Council is considering a proposition submitted by Albert C. Moore, civil engineer, of Joplin, Mo., for the installation of a municipal electric-light and water plant.

BAKERSFIELD, CAL.—Bids will be received until Feb. 10 by the Board of Supervisors for a 50-year franchise to erect transmission lines across certain highways in Kern County, application having been made by the Southern Sierra Pwr. Co., of San Bernardino.

COVINA, CAL.—The City Council has authorized the city engineer to prepare plans and specifications for the installation of an ornamental street-lighting system to include Center Street, Badillo Avenue and Citrus Avenue. The Council is also investigating the entire lighting system.

DOWNIEVILLE, CAL.—Albert C. Agnew, attorney, of Oakland, has asked the Board of Supervisors to advertise for sale a franchise, covering a period of 50 years, to erect and maintain transmission lines for the purpose of transmitting electricity for lamps, heaters and motors along certain highways and public roads in Sierra County. The franchise will be advertised for sale.

HEMET, CAL.—The successors to the Ramona Pwr. Co. expect soon to begin on the construction of a large dam and reservoir at the foot of Strawberry Valley, 2 miles below Idyllwild, in the San Jacinto Mountains. A high-tension transmission line will also be erected to San Jacinto Valley to connect an irrigation pump load.

LINDSAY, CAL.—The Tulare County Pwr. Co., of Lindsay, has applied to the State Railroad Commission for permission to issue bonds to the amount of $500,000 to be used for extensions and development work.

LIVE OAK, CAL.—The Board of Supervisors has adopted a resolution calling for bids for furnishing electricity for lamps and motors for the town of Live Oak and for the installation of a lighting system. A bid for furnishing electricity for Sutter County has been submitted by the Oro Lt. & Pwr. Co., of Oroville.

LOS ANGELES, CAL.—The Southern California Edison Co. will build substations at Whittier, Monrovia, Torrance, Katella, Puente, Chino and Slauson. The stations will cost from $16,000 to $56,000 each. Additions will be made to existing substations, at a cost of about $136,000.

NEWPORT, CAL.—The Board of Trustees has decided to build a distributing system and purchase energy from one of the large power companies. The city recently voted to issue $25,000 in bonds to acquire the local plant owned and operated by C. H. L. Ghriest. The trustees considered the price placed on the plant prohibitive, and have decided to build a system. Bids will soon be asked for material for the proposed plant.

RIVERSIDE, CAL.—Paul Shoop, president of the Pacific El. Ry. Co., has announced that the company will extend the railway from Riverside, via Arlington, to Corona, a distance of 15 miles.

RIVERSIDE, CAL.—Plans and efficiency report have been completed on municipal lighting plant at Riverside. Plans call for an expenditure of $429,112 on a hydroelectric plant and $100,351 on a steam reserve plant, or for an alternate oil-engine plant of 2000-kw capacity, $200,000. Burns & McDonnell, of Kansas City, Mo., are engineers. H. L. Cree is city clerk.

SACRAMENTO, CAL.—No bids were submitted to the City Commissioners in connection with the work of installing electric conduits for the electroliers of the city. The work will probably be done under the direction of the commissioner of public works. The cost of the work is estimated at about $10,000.

SAN FRANCISCO, CAL.—The Great Western Pwr. Co. has applied to the State Railroad Commission for permission to issue approximately $4,000,000 in bonds for the purpose of completing the large dam and reservoir at Big Meadows on Feather River.

DOLORES, COL.—Plans are under consideration for the construction of a large hydroelectric power plant on the Dolores River, a few miles above Dolores. The proposed plant will supply power and water for the irrigation of 200,000 acres of land extending north to the southern limits of Paradox Valley and west into Utah. E. P. Ripley, president of the Santa Fé railroad, is to be president of the irrigation company, which is installing the project on the Dolores; Fred L. Lucas, of Denver, is engineer in charge of the work. Mr. Lucas recently took over the Anterolost Park Irrigation Co., near Denver, and is now negotiating for the purchase of the Redlands power plant, near this city.

GRAND JUNCTION, COL.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 5, for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Grand Junction, Col. Drawings and specifications may be obtained at the above office or from the custodian of site at Grand Junction. O. Wenderoth is supervising architect.

NEW HAVEN, CONN.—The United Illg. Co. is considering plans for the transfer of its generating station in George Street to another section of the city.

WASHINGTON, D. C.—The municipality of Chalons-sur-Marne, France, invites tenders for electrically operated pumps at the city water works. Particulars may be obtained of the Mayor. For further information address No. 10,284, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—Tenders will be received by the Federal Swiss Railways, Berne, Switzerland, for the construction and equipment of a generating station at Amsteg, to cost approximately $60,000. For further information address No. 10,276, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—An American consul reports that an electric street railway will be built in his district. The contract has been undertaken by a local company and work will probably begin in the fall of 1913. Further information may be secured by addressing No. 10,267, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—The American Legation at Montevideo, Uruguay, has forwarded the original and translation of a bill recently sanctioned for the state monopoly of electric light and power in that country. It is stated that tenders will be called immediately for the power houses needed. There are to be 15 power houses, plans for which have already been prepared. The approximate cost of each is given as from $25,000 to $31,000. Copies of the complete report and translation will be sent on application No. 10,273, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

ARCADIA, FLA.—The Arcadia El. Lt. & Tel. Co. is planning to enlarge its plant and install additional machinery.

JONESBORO, GA.—At an election held Jan. 21 the proposition to enter into a contract with the Central Georgia Transmission Co. for electricity, with 24-hour service, and to issue $10,000 in bonds to be used for building and equipping a transforming station in Jonesboro, was carried.

BRUNEAU, IDAHO.—The Great Shoshone & Twin Falls Wtr. Pwr. Co., of Twin Falls, does not contemplate the construction of a plant in Bruneau, as published in the issue of Jan. 18, but has under consideration the extension of its transmission line to this place. J. H. Seavier is assistant general superintendent.

ALTON, ILL.—The Alton, Granite & St. Louis Trac. Co. has decided upon a site for its proposed new power house in Alton to furnish electricity for the East Side system. A site of 17 acres has been secured on the riverbank. The new power plant will have an output of 6000 kw and will supply electricity to a large territory, including Alton. The present power house at Sixth and Piasa Sreets will be abandoned when the new plant is completed.

ARENZVILLE, ILL.—The Central Illinois Pub. Ser. Co. is reported to be seeking a franchise to construct and operate an electric-light plant in Arenzville.

BARDOLPH, ILL.—The Village Board has granted the Central Illinois Pub. Ser. Co., of Mattoon, a franchise to operate an electric-lighting system in Bardolph. A ten-year contract has been awarded the company for lighting the streets, providing for 100-cp tungsten lamps, at $32 each per year.

BEARDSTOWN, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the property of the Beardstown El. Lt. & Pwr. Co. It is reported that extensive improvements will be made to the plant and the output increased from 325 kw to 8000 kw, involving an expenditure of about $100,000. A transmission line will be erected from Beardstown to Rushville, and another up the Illinois River to Havana, supplying the numerous drainage district pumping stations with electricity. Another line will be erected south to the Coal Creek levee and drainage district, where two pumping stations will be supplied with energy, and on south to Valley City. It is expected that transmission lines will be built to Browning and Frederick.

CLINTON, ILL.—The plans for the proposed ornamental street-lighting system provide for the erection of at least 124 iron standards, each carrying one 60-watt and four 40-watt lamps. Wires will be placed underground and armored cable will be used. The cost of the work is estimated at about $18,000. L. W. Lemon, city engineer, is chairman of Board of Local Improvements.

EAST MOLINE, ILL.—The Village Board has voted to accept a contract submitted by the People's Pwr. Co., of Moline, whereby the company will supply electricity to operate the water-works pumping station for $1,200 per year. The contract for street lighting was

renewed for five years. The contract calls for a minimum of 25 arc lamps at $65 each per year and tungsten lamps at $21 per lamp per year.

LA PRAIRIE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has applied to the Village Board for a franchise to operate an electric-light system in La Prairie. The company recently purchased the electric plant in Augusta and proposes to erect a transmission line to Golden by the way of La Prairie.

LIVINGSTON, ILL.—The village of Livingston is installing a distributing system and street lamps. Electricity for operating the system will be purchased from the Twin City Lt., Ht. & Pwr. Co., which operates a transmission line from the power plant of the Madison County Lt., Ht. & Pwr. Co. at Worden to a substation in Livingston. S. M. Westwood is president of the company and D. E. Aylward secretary. The Dixon-Smith Engineering Co., Wright Building, St. Louis, Mo., has charge of the work.

MARINE, ILL.—The electric-light plant proposed by local capital may be combined with the ice plant of the Marine Packing Co.

MARSHALL, ILL.—G. A. Hallauer, who is building an ice plant here, has submitted a proposition to the City Council offering to purchase the municipal electric-light plant. He asks for a 25-year franchise, promises to pay off the present indebtedness of $8,500 and to pay $500 per year for the franchise and to furnish 150 street lamps at $2,700 per year. In addition, he offers to furnish electricity, free of charge, for lamps about the public square if the city will furnish the ornamental lamps. It is estimated that it will require an expenditure of about $20,000 to put the plant in shape to give adequate service.

MOKENA, ILL.—The Village Board has awarded a contract to the Gould Pump Co., of Chicago, for the installation of an electrically driven pump at the water-works station.

PAWNEE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has asked the Village Board for a new franchise to operate an electric-lighting system in Pawnee.

QUINCY, ILL.—The City Council has decided to employ an electrical engineer to prepare plans for the installation of a fire-alarm system and then to advertise for bids. Estimates submitted for the system vary from $16,500 to $28,000.

SPRINGFIELD, ILL.—Property owners headed by Mayor John S. Schnepp have asked the city commission to install ornamental lamps on Adams Street, between Tenth Street and Forest Park, a distance of about 15 blocks.

SPRINGFIELD, ILL.—With the installation of a generator and motors at the city water-works pumping station on the Sangamon River the municipal electric-light plant which supplies electricity for lighting the streets will gradually be dismantled and within a year all energy will be furnished from the water-works station.

SPRINGFIELD, ILL.—The plans for the proposed extension to the ornamental street lighting provide for about 135 ornamental standards, cast iron or concrete, to be maintained by underground wires. In the business district the standards will carry one 60-watt and four 40-watt Mazda lamps and in the residential district one 100-watt Mazda lamp. Contract for installing the system will probably be awarded in March. The cost of the system is estimated at about $12,000. J. E. Dalby is superintendent of the municipal electric-light plant.

WHITE HALL, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the electric light, heating and power department of the White Hall Sewer Pipe Co. for $100,000.

WINCHESTER, ILL.—The property of the Winchester El. Co. has been purchased by the Central Illinois Pub. Ser. Co., of Mattoon.

FRANKFORT, IND.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1 for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Frankfort, Ind. Drawings and specifications may be obtained from the above office or from the custodian of site at Frankfort. O. Wenderoth is supervising architect

MONTICELLO, IND.—The Monticello Hydraulic Co. has completed its transmission line as far as Walcott. It is now extending the line on to Goodland and Remington and will also supply these towns with electricity for lamps and motors.

WILLIAMSPORT, IND.—The purchase of a 133-cycle alternating-current generator and exciter for the municipal electric-light plant is contemplated. Charles E. Brooks is city clerk.

AMES, IA.—A special election will be held Feb. 10 to submit a proposition authorizing the City Council to expend $25,000, or as much as is needed, from the accumulated and future earnings of the Electric Light Department for building a new electric-light plant.

CEDAR RAPIDS, IA.—The Iowa City Ry. & Lt. Co. is negotiating with the City Council for the city's right in dam and water rights and proposes to build a combined dam and bridge at Avenue B.

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion St. Ry. Co. has applied to the City Council for a franchise to cross the new Third Avenue Bridge and announces that it proposes to build 5 miles of new road and reconstruct 3 miles of track.

CENTERVILLE, IA.—The Centerville Lt. & Trac. Co. will begin work on the erection of a transmission line to Mystic in about 30 days.

HULL, IA.—The Town Council has granted a franchise to D. J. Vander-Schaff to construct and operate an electric-light plant in Hull. The town agrees to use 30 or more 60-cp tungsten lamps for lighting the streets of the town at $25 each per year for a period of five years.

MARCELINE, IA.—The City Council is considering a proposition submitted by parties representing the Mississippi River Pwr. Co., which is erecting a large power plant at Keokuk, Ia., to furnish electricity to operate the municipal electric-light plant. The proposed transmission line through Linn County to Chillicothe and Trenton will come within 4 miles of Marceline.

MARSHALLTOWN, IA.—Plans are being prepared by the Iowa Ry. & Lt. Co. for increasing the output of its local plant. The proposed work will include the construction of a building to be used exclusively for boiler room. Contract has been awarded for a new 2100-hp Westinghouse turbine. A new cooling tower will be erected, 40 by 70 ft., having a capacity of 100,000 gal. A generator is to be installed to supply service in emergencies and transformers for high-tension service and also material for erection of transmission lines leading east of Marshalltown to Tama, Toledo and eventually to Cedar Rapids.

ROCKWELL, IA.—C. C. Carhart, of Sheffield, Ia., has applied to the Village Board for a franchise to operate an electric-light system here. Mr. Carhart proposes to erect a transmission line from his plant in Sheffield to Rockwell to funish energy to operate the system here.

SHEFFIELD, IA.—C. C. Carhart, owner of the local electric-light plant, contemplates extending a transmission line from Sheffield to Rockwell to supply electricity for lamps and motors there. Application will soon be made for a franchise in Rockwell.

TOLEDO, IA.—The Iowa Ry. & Pwr. Co. contemplates extensive improvements to its local plant. The present plant will be remodeled and made an emergency station, at a cost of about $30,000. The street-lighting system will be extended to all parts of the city.

ARCADIA, KAN.—At an election held Jan. 15 the proposition to issue $7,500 in bonds for the installation of an electric-light plant was carried. Bids will be called some time in February. E. T. Archer & Co., New England Building, Kansas City, Mo., consulting engineers, have charge of the work.

KINGMAN, KAN.—The entire issue of $45,000 in bonds recently authorized for the installation of a municipal electric-light plant has been sold. Active work will soon begin on the construction of the plant.

MILTONVALE, KAN.—Plans are being prepared for the construction of a municipal electric-light plant, to cost about $32,000. E. T. Archer & Co., of Kansas City, Mo., have charge of the engineering work.

TOPEKA, KAN.—Sealed bids will be received by the State Board of Control, Topeka, Kan., until Feb. 8 for furnishing electric lamps to the state charitable institutions of Kansas for a period of one year. Contract will be awarded upon a basis of 5000 lamps to be delivered as ordered by the chief executive officer of the following institutions: Topeka State Hospital, Topeka; Osawatomie State Hospital, Osawatomie; State Hospital for Epileptics, Parsons; State Home for Feeble-Minded, Winfield; School for Deaf, Olathe; School for Blind, Kansas City, Kan.; State Orphans' Home, Atchison; Boys' Industrial School, Topeka, and Girls' Industrial School, Beloit. Bidders will make one price covering carbon lamps from 2 cp to 24 cp, another price covering 32-cp lamps; also prices covering Gem, Mazda and tungsten lamps, same candlepower as above, and as high as 60 cp; these lamps to be upon Edison base, 110-volt. N. C. Bowman is chairman of board.

LEXINGTON, KY.—The Burrell Engineering & Construction Co., of Chicago, Ill., has been engaged by the Blue Grass Commission Co., of Lexington, to prepare plans and erect an electrically operated grain elevator in this city.

LOUISVILLE, KY.—A decision has been handed down requiring the Kentucky El. Co., of Louisville, to continue in competition with the Louisville Ltg. Co. and other public utilities of similar character in this city until its franchise expires. This decision practically makes impossible the sale of the company's plant.

LOUISVILLE, KY.—The Louisville Ltg. Co. has entered into a contract with the Wedgerite Chemical Co., a new concern which will manufacture high explosive, to supply electricity to the Wedgerite powder mills, to be located 2 miles south of Kenwood Hill. The contract will necessitate an extension of the transmission line of the lighting company over Kenwood Hill. Six motors are to be purchased by the powder company for the initial installation.

DONALDSONVILLE, LA.—The contract for the construction of the power house for the new municipal electric-light plant has been awarded to R. L. Stewart for $8,000, subject to the approval of the Louisiana Fire Prevention Bureau.

CATONSVILLE, MD.—The Baltimore County Commissioners have awarded the contract for street lighting in Catonsville to the Patapsco El. & Mfg. Co., of Ellicott City. The contract is for a period of two years. Victor G. Bloede, of Baltimore, Md., is president of the company.

WILLIAMSPORT, MD.—Ernest R. Gentis, superintendent of the Frederick & Hagerstown Pwr. Co., of Hagerstown, has submitted a proposition to the Burgess and Commissioners of Williamsport offering to furnish electricity for lighting the streets of the town, giving an all-night service, at $65 per arc lamp per year.

BOSTON, MASS.—The stockholders of the New England Pwr. Co. have voted to increase the capital stock of the company from $1,500,000 to $3.250,000.

SIDE GUIDE AND GRIPPER

BROCKTON, MASS.—Steps have been taken toward the installation of an ornamental street-lighting system in the business district. Arthur H. Andrews, president of the Chamber of Commerce, is leader of the movement.

FALL RIVER, MASS.—The Fall River El. Lt. Co. has purchased the property adjoining its substation on Hartwell Street. The purchase of this plot will make it possible to enlarge the substation and storehouse. The company has announced that extensive improvements are to be made at the substation within the next few months.

WESTFIELD, MASS.—The Amherst Pwr. Co. has submitted a proposition to the Municipal Light Board offering to furnish electricity to consumers through the municipal electric-light plant. The municipal electric-light plant is furnishing from 800 hp to 900 hp during the day and will call for an appropriation of $20,000 this spring to enlarge the power plant, increasing the output by 750 hp. This will not be done if the proposition of the Amherst company is accepted.

ALPENA, MICH.—The Great Lakes Lime & Stone Co., recently organized with a capital stock of $1,500,000, will build a lime plant with an output of 200 tons per day; the rock crusher plant will be capable of handling 12,000 tons of rock each day. Much electrical equipment will be required, for which, it is said, bids will soon be received. E. P. Smith is at the head of the project.

DETROIT, MICH.—The Detroit General Hospital will install a power plant to furnish electricity for lamps and motors to the various buildings.

DETROIT, MICH.—The Public Lighting Commission has asked the Common Council for an appropriation to build underground conduits from the power plant to the new office building.

DETROIT, MICH.—A petition has been presented to the Public Lighting Commission asking that the cluster lamps on Michigan Avenue be extended westward to Martin Avenue; also that 12 lamps be erected on both sides of the walk in the subway at Twentieth Street and Michigan Central Railroad.

GRAND RAPIDS, MICH.—Plans have been prepared by Wernette & Bradfield, engineers, for the construction of a one-story power house for the White Lake Lt. & Pwr. Corpn. at Montoque, to be built of cement block.

PONTIAC, MICH.—The Michigan State Tel. Co. has been notified to place its wires underground on West Pike Street, Williams Street, Mount Clemens Street and Saginaw Street.

SHEPHERD, MICH.—The municipal electric-light plant has been closed down and electricity will be furnished by the Consol. Pwr. Co. at 5 cents per kw-hr., with a 24-hour service.

FULDA, MINN.—The Fulda Lt. & Pwr. Co. has made arrangements to supply electricity in Kinbrae and Dundee and also to farmers along the line. The company will erect a transmission line from its power plant in Fulda to the villages of Kinbrae and Dundee.

HIBBING, MINN.—The Water and Light Commission has decided to engage an electrical engineer to make investigations of the municipal electric-light plant and submit a report of improvements needed to bring the plant up to the highest standard of efficiency and economical operation.

NORWOOD, MINN.—The Lethert El. Co., of St. Paul, represented by J. W. Schulter and F. C. Fitzgerald, has applied to the Village Council for a franchise to furnish electricity here. The company expects to erect several plants in this section and proposes to furnish electricity in towns as far west as Montevideo and as far north as Eden Valley, where a plant is already in operation.

ROYALTON, MINN.—The Royalton Pwr. & Lt. Co is now receiving electricity from the plant at Little Falls and is furnishing a 24-hour service. The installation of a new street-lighting system is under consideration.

WARROAD, MINN.—The Village Council is considering the question of installing a municipal electric-light plant this spring.

JACKSON, MISS.—The Jackson Ry. & Lt. Co. will install a new street-lighting system in Jackson in the near future. The company has not yet decided upon what method it will adopt.

ESSEX, MO.—The Dexter El. Lt., Ht. & Pwr. Co., of Dexter, has applied to the City Council for a franchise to install an electric-lighting system in Essex. If granted a franchise, the company will begin work at once on construction of the plant.

ST. CHARLES, MO.—The Mississippi River Pwr. Distributing Co., of Keokuk, Ia., has applied to the City Council for a franchise to supply electricity for lamps and motors in St. Charles.

DAVID CITY, NEB.—Frank Humpal has submitted a proposition to furnish electricity for lighting the streets of the city and for commercial and residential lighting. Mr. Humpal is operating a small plant and if granted a contract and franchise will enlarge his plant to supply the service. The city has been without street-lighting service for more than a year and a half.

PLATTSMOUTH, NEB.—The Nebraska Ltg. Co., of Plattsmouth, has decided to increase the output of its plant with a view of furnishing electricity for lamps and motors in the surrounding towns and to farmers in the east end of the county. Albert Clabaugh is superintendent.

GOLDFIELD, NEV.—The Goldfield Oro Co. is planning to install electrically operated compressors and drills.

FREEHOLD, N. J.—The Monmouth Lt. Co., which furnishes electricity for lamps and motors in Freehold, Englishtown and Marlboro, contemplates substantial improvements to its plant and extensions to the service. Captain Peter Vredenburgh is president and David H. Smith treasurer of the company.

GLOUCESTER CITY, N. J.—The Delaware & Atlantic Tel. & Tel. Co. has applied to the City Council for permission to install an underground system on Bergen Street.

LAMBERTVILLE, N. J.—The property of the Lambertville Ht., Lt. & Pwr. Co. has been taken over by F. Stanley North, of Bay Shore, N. Y., and associates. The new owners contemplate extensive improvements to the local plant and extension of service in the near future. For the present plant will be under the management of T. F. Axtell.

MERCERVILLE, N. J.—The Public Ser. El. Co. will install a new lighting system in Hamilton Township, taking in Hamilton Square and Mercerville.

PATERSON, N. J.—The El. Pwr. Co. has applied to the Board of Public Works for a franchise to supply electricity in Paterson. The company proposes to develop 48,000 hp on the Neversink River, near Monticello, and transmit power to Paterson, Passaic and other New Jersey cities. C. A. Cahan, of Montreal, Que., Can., is president of the company and Carl C. Giles is manager.

PERTH AMBOY, N. J.—For the purpose of encouraging the merchants to erect ornamental lamps the city will agree to bear 25 per cent of the cost of maintaining the lamps where 10 or more lamps are installed.

PHILLIPSBURG, N. J.—The Phillipsburg Lt., Ht. & Pwr. Co., has applied to the City Council for a franchise to supply electricity for lamps and motors in Phillipsburg.

SOUTH RIVER, N. J.—The Board of Public Works has recommended to the Borough Council extensions and improvements to the municipal electric-light plant, involving an expenditure of about $25,000, as follows: (1) One 300-hp suction gas producer in addition to the one contracted for, together with complete appurtenances; (2) one 300-hp, four-cylinder gas engine direct-connected; (3) one 200-kva multiphase alternating-current generator, with exciter; (4) switchboard and instruments, including automatic voltage regulator; (5) addition to power house to provide room for new equipment; (6) equipment for 50 additional street lamps, including transformers, regulators and line construction; (7) line extensions, transformers, etc.

TRENTON, N. J.—Plans are being considered by the Merchants' Committee and the Board of City Commissioners for the installation of additional ornamental street lamps in the business section and will soon open negotiations with the Pub. Ser. El. Co. for same.

BELEN, N. M.—Plans are being prepared for the installation of an electric-light plant in Belen. Local capitalists are interested in the project.

BUFFALO, N. Y.—Proposals will be received by the Commissioner of Public Works, Room 5, Municipal Building, Buffalo, until Feb. 21, for construction of a new high school building, to be known as the Hutchinson Central High School and to be located on the corner of South Elmwood Avenue and Chippewa Street. A separate proposal must be submitted for the following divisions of the work: (a) Masonry; structural iron and steel work, including ornamental iron and brass work; fireproofing; carpentry work; roofing, including skylights, sheet-metal work, etc.; marble and tile work; electric wiring, switchboards, telephone system, lighting fixtures, etc.; elevators, ash-hoists, etc.; (b) heating, ventilating and power-plant equipment, including boilers, pumps, tanks, fans, motors, high-pressure piping, radiation, temperature regulation, air-washers, humidifiers, etc.; (c) plumbing, drainage and gas-fitting, including water heaters, water-purifying and filtration apparatus, etc. Plans and specifications are on file and may be examined at the office of the deputy building commissioner, Room 6, Municipal Building, Buffalo, where blank forms of proposals and other information may be obtained. Francis G. Ward is commissioner of public works.

DRESDEN, N. Y.—Negotiations are under way between the village of Dresden and the Taylor Chemical Co., whose plant is located on the outlet of Lake Keuka, about 2 miles from Dresden, for lighting the town by electricity. E. R. Taylor is president of the company.

GENEVA, N. Y.—Bids will be received by the Common Council until Feb. 6 for the installation of an inter-lighting system for the business section of the city. Bids are asked on three different propositions as follows: (1) For 72 Chester lamps; (2) 72 lamps of 400 cp; (3) 72 ornamental boulevard type poles. In addition bids will be received for illuminating Exchange Street from the railroad to North Street with 18 lamps of 60 cp.

HADLEY, N. Y.—The Public Service Commission, Second District, has authorized the Town Board of Hadley to engage in the sale of electricity for other than municipal purposes. A lighting district has been established in the township.

MECHANICSVILLE, N. Y.—The Village Board of Trustees has rejected all bids submitted for street lighting and new bids will be called for, which are also to include the maintenance and operation of the fire-alarm system.

NEW YORK, N. Y.—The Long Acre El. Lt. & Pwr. Co. has applied to the Public Service Commission, First District, for a certificate approving the construction of its plant.

NEW YORK, N. Y.—Sealed bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until

SIDE GUIDE AND GRIPPER

Feb. 5 (extension of date from Jan. 21), for furnishing all labor and material required for the inspection and maintenance of electrical apparatus as follows: (a) For the boroughs of Manhattan and Bronx; (b) the boroughs of Brooklyn and Queens; (c) the borough of Richmond. Blank forms and further information may be obtained at the office of the chief engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NIAGARA FALLS, N. Y.—The City Council is considering a charter amendment bill permitting the city to install a municipal electric-light plant.

BANNERS ELK, N. C.—A 75-kw hydroelectric power plant is being installed at Banners Elk. Prof. J. A. Switzer, Knoxville, Tenn., is in charge of the hydraulic work and D. R. Shearer, of Knoxville, Tenn., has charge of designing the electrical plant and installation of same.

GLEN ALPINE, N. C.—The North State Pwr. Co., of Morgantown, contemplates the construction of a hydroelectric power plant across the Catawba River opposite Glen Alpine, 4 miles from Morgantown. Electricity generated by the plant will be transmitted to Morgantown, Marion and Lenoir.

DEVIL'S LAKE, N. D.—Sealed bids will be received until Feb. 10 for the installation of an ornamental street-lighting system. Plans and other information may be obtained at the office of W. E. Bryant, city auditor. P. J. McClory is Mayor.

CAMBRIDGE, OHIO.—The Brooks Syndicate, United Service Co., of Scranton, Pa., has closed a deal whereby it acquires the property of the Midland Pwr. & Traction Co., which operates the local electric-light plant and street-railway system and the Cambridge-Byesville interurban line. The company owns the electric plants in Coshocton, New Philadelphia, Uhrichsville and Dennison and the interurban railway which connects the last three cities named. The new owners contemplate the erection of a transmission line to connect Cambridge, Coshocton and New Philadelphia, to cost approximately $150,000. L. H. Conklin, of Scranton, Pa., is manager of the United Service Co. P. B. Barnhard, of New Philadelphia, has been chosen vice-president of the new Cambridge company.

COLUMBUS, OHIO.—Sealed proposals will be received by the director of public service, City Hall, Columbus, Ohio, until Feb. 4 for furnishing approximately 50,000 ½-in. by 12-in. cored carbons and approximately 50,000 ½-in. by 12-in. solid carbons for the municipal electric-light plant. S. A. Kinnear is director of public service.

COLUMBUS, OHIO.—Proposals will be received by the director of public service, City Hall, Columbus, until Feb. 4, for furnishing lamps as follows: 200 30-watt gem lamps, 1000 40-watt gem lamps, 300 80-watt gem lamps, 800 16-cp refilled lamps, 200 60-watt gem lamps, 200 25-watt tungsten lamps, 200 40-watt tungsten lamps, 300 60-watt tungsten lamps, 4000 100-watt tungsten lamps, 96 150-watt tungsten lamps, 96 250-watt tungsten lamps, 8 500-watt tungsten lamps and 800 60-cp street series lamps. S. A. Kinnear is director of public works.

EAST LIVERPOOL, OHIO.—The City Council has engaged Sidney B. Martin, consulting engineer, Glanshaw Building, Pittsburgh, Pa., to prepare plans for the construction of a municipal electric-light plant for the city. The Council has authorized a $60,000 bond sale to provide funds for the municipal electric-light plant.

LORAIN, OHIO.—The Cleveland, Columbus & Southwestern Ry. Co., of Cleveland, has applied to the City Council for a franchise to furnish electricity for lamps in Lorain.

STEUBENVILLE, OHIO.—The City Council and a committee of the Chamber of Commerce have advised the Steubenville & East Liverpool Ry. & Lt. Co. to install additional machinery in its power plant. The city probably will not build a municipal electric-light plant.

ELK CITY, OKLA.—The Elk City Lt. & Pwr. Co. and the Elk City Ice & Fuel Co. have been consolidated under the name of the Elk City Ice, Fuel & Lt. Co. with a capital stock of $60,000. It is understood that E. W. Merrifield, superintendent, has been instructed to secure bids on a new 200-kw generator and engine. W. E. Corn will be general manager of the new company.

CORVALLIS, ORE.—The Corvallis & Eastern Ry. Co. is planning to install a new boiler, additional motors, etc., in its power house during the coming year. D. M. McLaughlin will have charge of the work.

MILTON, ORE.—Plans are being prepared for the construction of a 2000-hp plant on the Walla Walla River, 7 miles above Milton. A company, to be known as the Walla River Pwr. Co., has been incorporated to build and operate the proposed plant. Local capitalists are interested in the project.

ERIE, PA.—The County Commissioners have awarded the contract for lighting the court house and county jail for the ensuing year to the Erie Ltg. Co. at 2.9 cents per kw-hr.

FRANKLIN, PA.—Steps have been taken toward the installation of ornamental street lamps on Liberty and Thirteenth Streets. The proposed system will be installed by the Franklin El. Co. and the cost of maintenance borne by merchants and property holders on the streets named. B. F. Ott is superintendent of the company.

GEIGER'S MILLS, PA.—The Geiger Mill property has been purchased and will be converted into an electric-light plant. A company has been organized under the name of the Geigertown El. Lt. & Improvement Co., with a capital stock of $15,000. The mill property will be taken over April 1. The officers of the company are: E. M. Zerr, president; J. Wesley Wolf, secretary, and H. G. McGowan, treasurer.

NEWVILLE, PA.—The property of the Big Spring El. Co., of Newville, has been taken over and will be operated by the Cumberland Ry. Co., of Carlisle. Extensive improvements are being made to the power house of the railway company along the Conodoguinet Creek, near Newville, to provide for the increasing business on the Newville division. W. H. McCrea, of Newville, is president of the Cumberland Ry. Co. and L. Richards, of Carlisle, general manager.

PITTSBURGH, PA.—Governor Tener has approved the merger of 28 electric companies chartered in Allegheny, Washington, Greene and other counties into the West Penn Ltg. Co. The company is capitalized at $547,000 and W. S. Kuhn, of Pittsburgh, is president.

TITUSVILLE, PA.—The business men on Spring and Franklin Streets are contemplating the installation of ornamental lamps on those thoroughfares.

PROVIDENCE, R. I.—Approximately 4000 new incandescent electric lamps will be installed in various parts of the city at once. The lamps are no. to replace others, but are all new locations. About 800 of these lamps will be on underground connections with ornamental iron posts and globes. Many new arc lamps will also be put into commission near the enter of the city. Work is already under way and is being done under the direction of Electrical Engineer Burnett.

DRESDEN, TENN.—The City Council contemplates making application to the State Legislature for authority to issue bonds for the installation of an electric-light system.

DUCKTOWN, TENN.—The Burra Mining Co. contemplates increasing the output of its power plant. Additional machinery will be installed, including boilers and electric generators to supply electricity for underground haulage, pumping and lighting mines.

HALLS, TENN.—We are advised that the Halls Service & Machinery Co., of Halls, has abandoned its proposed electrical project for the present.

MEMPHIS, TENN.—The property owners on Main Street are contemplating the installation of an ornamental street-lighting system, covering a distance of about 2 miles. Plans provide for 275 ornamental lamp standards, each carrying five lamps, similar to those on Madison Avenue. J. S. Dunscombe is interested in the project.

DALLAS, TEX.—The proposition to establish a municipal electric-light plant in Dallas will be submitted to the voters in April. The cost of a plant to supply electricity for the business part of the city is estimated at $373,000.

ELGIN, TEX.—The Elgin Lt. & Pwr. Co. expects to purchase within the next two months an engine direct-connected to alternator, electrically operated feed pumps, marble switchboard, transformers and poles and miscellaneous electrical appliances and supplies. Thomas L. Deisch is president.

MANOR, TEX.—Work will begin at once on the installation of an electric-lighting system in Manor. W. M. Allison is interested in the project.

PLANO, TEX.—The Wilcox Lt. & Pwr. Co., which has purchased the property of the Plano Lt. & Pwr. Co., is contemplating improvements to the plant, work on which will begin in April or May. The work will include the installation of one 75-kva, 19,100-33,000-220-440-volt transformer and the purchase of one carload of white cedar poles, 25 ft. to 40 ft. long. C. W. Potts is manager.

TEXHOMA, TEX.—At an election held recently the proposition to issue $25,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant and water-works system, was carried.

SALT LAKE CITY, UTAH.—Application has been filed with the State engineer by Thomas W. Cameron, Theodore K. Winkelar, Frank D. Wyant and other St. Louis capitalists for 2370 second-ft. of water daily from the Green River to be used for power purposes. It is proposed to divert the water about 3 miles south of the junction of the Green River and Minnie Creek in Carbon County. The work will consist of a dam, headgates, wasteway and steel pipes. Articles of incorporation will be filed as soon as possible and work will be started in the near future.

BURLINGTON, VT.—A bill has been introduced in the State Legislature allowing the city of Burlington to issue $50,000 in bonds, the proceeds to be used to enlarge the municipal electric-light plant.

BURLINGTON, WASH.—The Independent Tel. Co. is planning to make extensive improvements in its service at Burlington.

CENTRALIA, WASH.—The Lewis County Commissioners have granted a franchise to the United States government for the construction of a telephone line from Lake Creek to Crandle, a distance of 25 miles. The line will be used by the forestry service.

CENTRALIA, WASH.—The Cougar Flats Tel. Co. has been granted a franchise by the Lewis County Commissioners to erect a telephone line. The line will be erected at once, and will connect with rural lines in the eastern part of Lewis County. William Booth is president of the company.

SEATTLE, WASH.—The City Council is considering the question of issuing additional bonds to the amount of $600,000 for extensions to the municipal street railway system.

SEATTLE, WASH.—E. M. Mills, representing bondholders and creditors of the Seattle, Renton & Southern Ry. Co., has applied to the

City Council for three franchises for extensions to the present electric system in the Rainier Valley.

TACOMA, WASH.—The Chicago, Milwaukee & Puget Sound Ry. Co. is planning to erect a power house on the tide flats, at a cost of about $5,000.

GRAFTON, W. VA.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 6, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, hydraulic mail lift and approaches, of the United States post office in Grafton. Drawings and specifications may be obtained at the above office or from the custodian of site at Grafton. O. Wenderoth is supervising archiect.

KENOVA, W. VA.—The Ohio Valley El. Co. is planning to erect a new transmission line from Kenova to Ashland and Ironton to provide better service for these cities. Work will begin on the line as soon as possible. The proposed line will require 35 miles of wire and will cost about $20,000.

MORGANTOWN, W. VA.—The Morgantown & Wheeling Rys. Co., recently organized, has taken over the Morgantown & Dunkard Rys. Co., which extends from Morgantown to Cassville. The new company proposes to build a railway from Cassville to Wheeling. Dr. L. S. Brock is president of the Morgan & Wheeling Rys. Co.

WELLSBURG, W. VA.—The City Council is considering the proposition to establish a municipal electric-light plant.

EAU CLAIRE, WIS.—It is announced that the Chippewa Valley Ry., Lt. & Pwr. Co. will build an electric line between Eau Claire and Altoona, an extension of the street-railway system to the South Side factory district and a loop in the downtown section of the city.

EAU CLAIRE, WIS.—The Eau Claire Business Men's Association has appointed a committee to promote the installation of an ornamental street-lighting system on North Barstow Street, South Barstow Street and Grand Avenue, east. J. E. Cass, president of the association, is chairman of the association.

MEDFORD, WIS.—Sealed bids will be received by Carl Herman, county clerk, Medford, Wis., until Feb. 15, for construction of court house for Taylor County, in accordance with plans and specifications prepared by Raeuber & Mehner, architects, of Manitowoc. Separate bids will be received for all general bids, heating and ventilating and electrical work. Plans and specifications are on file at the Builders' Exchange at St. Paul, Minn.; Builders' Exchange, Milwaukee, Wis.; Builders' Exchange, La Crosse, Wis.; Builders' Exchange, Fond du Lac, Wis., and Builders' Exchange, Chicago, Ill. Copies of plans may be secured from the architects upon deposit of $25 for general work and $10 for mechanical equipment.

MILWAUKEE, WIS.—The East Side Advancement Association will petition the Common Council to erect lamps on East Water Street similar to those on Grand Avenue.

MILWAUKEE, WIS.—For the thrid time the proposition to build a municipal electric-light plant will be submitted to the voters at the election to be held in April.

NEW WESTMINSTER, B. C., CAN.—The City Council has entered into an agreement with the British El. Ry. Co. whereby the company will supply the city of New Westminster with electricity for a period of 11 years. The company will erect a new substation at Sapperton, B. C.

VICTORIA, B. C., CAN.—The British Columbia Tel. Co. will erect a telephone line from Victoria to Nanaimo, a distance of about 60 miles. The cost is estimated at about $15,000. C. F. Bollschweler, of Victoria, is superintendent of construction.

WINNIPEG, MAN., CAN.—The Legislature has decided to adopt the resolution introduced by T. C. Norris asking that the Public Utilities Commissioners be authorized to investigate and report as to the feasibility of publicly owned hydroelectric power within the Province, with a view of securing for all sections of the Province, rural as well as urban, the benefits now enjoyed by the citizens of Winnipeg in power distribution.

GLACE BAY, N. S., CAN.—Plans are being considered for the installation of another boiler, condenser and turbine engine in the municipal electric-light plant.

SYDNEY, N. S., CAN.—The Cape Breton El. Co. has issued $100,000 in bonds, the proceeds to be used for permanent improvements to its system.

FLESHERTON, ONT., CAN.—The Georgian Bay Pwr. Co. has sold its plant at Eugenia Falls to the Ontario Hydro-Electric Power Commission for $60,000. The commission will build two large dams on the Eugenia River and pipe the water through the mountain near the falls, obtaining a head of nearly 500 ft. Electricity generated at the plant will be distributed in towns near Georgian Bay.

LONDON, ONT., CAN.—The Water Commissioners are contemplating utilizing the water-power of the Thames River to generate electricity with which to supply the peak load. It is estimated that 500 hp can be developed there. Work will begin on the installation of the machinery as soon as possible

ST. CATHARINES, ONT., CAN.—Plans are being prepared by the Niagara, St. Catharines & Toronto Ry. Co. for the construction of a new 1000-hp substation in St. Catharines, also one at Niagara-on-the-Lake having an output of 500 hp.

TORONTO, ONT., CAN.—Sealed tenders will be received by Hon. Adam Beck, chairman Hydro-Electric Power Commission, 709 Continental Life Building, Toronto, until March 17 for material required in construction of about 135 miles of transmission line to operate at 110,000 volts as follows: Galvanized steel towers, special crossing towers, copper cable, aluminum cable, insulators, galvanized malleable-iron clamps, galvanized pressed-steel clamps. Plans, specifications and form of contract can be seen and form of tender obtained at the above office.

WINDSOR, ONT., CAN.—Preliminary plans for transmitting electricity from Niagara Falls to Windsor, Ont., and the erection of a distributing plant, also for the laying of conduits, are being inspected by R. T. Jeffrys, hydroelectric engineer of Toronto. Overhead lines will be used between Windsor and London, which will be carried on steel towers. Much of the right-of-way has already been secured.

New Industrial Companies

THE ADAMANT BATTERY COMPANY, of Boston, Mass., has been incorporated with a capital stock of $20,000 to manufacture storage batteries, etc. The directors are: William L. Walker, 48 Beacon Street, Boston, Mass., president and treasurer; R. S. Barlow and A. G. Grant.

THE ELECTRIC CALL & ALARM COMPANY, of Oklahoma City, Okla., has been incorporated with a capital stock of $100,000 to manufacture electric alarms by P. A. Huddleson, D. M. Huddleson and A. L. Davis.

THE ELECTRIC TRANSPORT COMPANY has been incorporated under the laws of the State of Arizona with a capital stock of $5,000,000. The incorporators are: Arthur d'Romtra, Cape May Point, N. J.; Robert M. Ewing, of Philadelphia, Pa., and Robert H. Maris, of Wilmington, Del.

THE INCANDESCENT LIGHT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in lighting appliances and to do a general manufacturing business. The incorporators are: Fred E. Davis, Jay F. Lawrence and H. H. Hardinger.

THE JAMISON RAILROAD & ELECTRICAL SUPPLY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $50,000. The incorporators are: N. P. Coffin, W. J. Maloney, of Wilmington, Del., and C. H. Jarvis, of Jamaica, N. Y.

THE McARTHUR AUTOMATIC TRAIN CONTROL COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $200,000 by R. Boyd Cooling, of Wilmington.

THE McCRAY MANUFACTURING COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $50,000 by John E. McCray, Harold A. McCray and William W. Spencer. The company proposes to manufacture all kinds of electrical machinery and apparatus.

THE SECURITY ELECTRIC LAMP COMPANY, of Chicago, Ill., has been incorporated by Samuel Grossman, Louis Grollman and Morris A. Weinberg. The company is capitalized at $2,500 and proposes to manufacture and deal in electrical appliances.

THE TEMPLE ELECTRIC COMPANY, of Temple, Tex., has been chartered with a capital stock of $4,000 for the purpose of doing a general contracting business. The incorporators are: James E. Ferguson, C. A. Hughes and J. E. Love.

THE VICTOR ELECTRIC & STAMPING COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 to manufacture all kinds of electrical and novelty goods. The incorporators are: Morris Goldreich, Joseph Feniger, M. A. Riegler, B. Feniger and C. A. Cornsweet.

THE ZENITH LAMP COMPANY, of Boston, Mass., has been incorporated with a capital stock of $25,000 by E. H. Raddin, of Cliftondale; G. O. Willey, of East Lynn, and G. M. Faulkner, of Brookline. The company proposes to manufacture incandescent lamps, etc.

New Incorporations

EAST ST. LOUIS, ILL.—The Illinois Pwr. Co. has been incorporated with a capital stock of $100,000 to generate and distribute electricity and gas. The incorporators are: Julian Laughlin, P. Rohan and Herbert Charters.

ALEXANDRIA, IND.—The Indiana General Ser. Co. has filed articles of incorporation with a capital stock of $500,000 for the purpose of furnishing water and electrical service in Alexandria and other towns and cities. The incorporators are: J. F. Millikan, A. O. Hopper, C. L. Walling and C. W. Weir.

KNIGHTSTOWN, IND.—The Shaughter Avenue Tel. Co. has been incorporated with a capital stock of $5,000 by Walter Shirkle, Fred Shirkle, Richard W. Martin and George Newbury. The company is said to be in the market for material and equipment for a new telephone plant.

HOULTON, MAINE.—The Fellsmere El. Lt. & Ice Co. has been organized wkith a capital stock of $25,000 for the purpose of dealing in gas, electricity, ice or any mechanical or mercantile commodity. The

officers are: G. W. Boynton, president, and C. O. Grant, treasurer, both of Houlton, and C. P. Barnes, clerk.

YARMOUTH, MAINE.—The Royal River & Mfg. Co. has been incorporated by John Tanner, Philip F. Nestel and Walter B. Allen. The company is to be capitalized at not less than $150,000 and proposes to generate and distribute electricity for lamps and motors in the towns of Yarmouth and Freeport.

GRIFFIN CORNERS, N. Y.—The Fleischmann Tel. Co., has been incorporated with a capital stock of $25,000 by A. H. Todd, George A. Speenburgh and Sara C. Todd, of Griffin Corners.

ALLENTOWN, PA.—A charter has been granted to the Lehigh Lt. & Pwr. Co. with a capital stock of $200,000. This corporation was formed by the merger of ten companies.

GREEN LANE, PA.—A charter has been granted to the Green Lane Lt., Ht. & Pwr. Co. with a capital stock of $5,000. The company will operate in and around Green Lane.

HARRISBURG, PA.—Charters have been granted to the Upper Chichester Township El. Co. and the Lower Chichester Township El. Co., both to operate in Delaware County. Each company is capitalized at $5,000.

PITTSBURGH, PA.—The McKee's Rocks Lt., Ht. & Pwr. Co. has filed articles of incorporation at Dover, Del. The company is capitalized at $150,000 and will generate electricity for lamps, heat and motors. The incorporators are: S. L. Lambert and G. G. Williams, of Pittsburgh, and Homer Lambert, of McKee's Rocks.

BISHOP, TEX.—The Bishop Wtr. & Lt. Co. has been incorporated with a capital stock of $50,000 by F. Z. Bishop, R. R. Hall and H. T. Ellsworth.

MILWAUKEE, WIS.—The Wisconsin Ry., Lt. & Pwr. Co. has been incorporated with a capital stock of $1,000 by N. F. Adams, J. B. Black and J. G. Hardgrove.

TORONTO, ONT., CAN.—The Dominion Trac. & Ltg. Co. has been incorporated with a capital stock of $12,500,000 for the purpose of generating and distributing electricity for lamps, heaters and motors.

Trade Publications

ELECTRIC SIGNS.—The Greenwood Advertising Company, 500 Charles Street, Knoxville, Tenn., illustrates and briefly describes in a thirty-two-page booklet some recent examples of electric signs designed for advertising purposes.

INSULATORS.—The Brookfield Glass Company, 2 Rector Street, New York, has recently sent out a twelve-page catalogue which illustrates forty-two types of its insulators, among which are pin insulators for 40,000 volts and a suspension-type insulator.

LAMPS.—The General Electric Company is distributing Bulletin No. 4850C, which deals with the standard line of multiple drawn-wire tungsten lamps for ordinary commercial circuits. It is divided into four parts—construction, classification, uses and application.

MOTORS.—Catalog No. 177 of the Sprague Electric Works of General Electric Company, New York, contains brief illustrated descriptions of generators, motors, electric equipments for printing machinery, exhaust-fan outfits, electric hoists and other apparatus.

VACUUM CLEANERS.—A folder referring to "Invincible" vacuum cleaners, manufactured by the Electric Renovator Company, Pittsburgh, Pa., illustrates and gives names and prices of nine types of its cleaning apparatus. The publication will interest central-station men.

WIRE.—The Bridgeport Brass Company, Bridgeport, Conn., gives a little advertising talk on its "Phono-Electric" wire on a 4.5-in by 5-in card that is being distributed. The suggestion is given to put up a section of its wire on the hardest spot in the line and watch results.

LIGHTING.—"How to Figure Illumination" is the title of a twenty-page booklet published by the Sunbeam Incandescent Lamp Works of General Electric Company. The object of this bulletin is to acquaint the general public with the most simple and up-to-date method of designing commercial and industrial illumination installations.

PHOTOMETERS.—A four-page folder issued by the Leeds & Northrup Company, Philadelphia, gives two illustrations and a brief description of its double-arm exploring mirrors, which are used for obtaining distribution curves of arc lamps and other large units. Catalog No. 60 refers to the Reichanstalt precision photometer and accessories and deals briefly with potentiometers also.

ELECTRICITY IN BAKERIES.—Bulletin No. A4073 of the General Electric Company deals with the electric equipment of bakeries and refers to the sanitary advantages derived from such an equipment and the efficiency, economy of space, convenience, cost and maintenance of apparatus in bakeries equipped with electric motors. It refers also to electric lighting and to electrically heated ovens for bakers' use.

WOODEN LIGHTING FIXTURES.—In the 1913 catalog (No. 15) of the W. B. Brown Company, Bluffton, Ind., a number of wooden electric lighting fixtures are illustrated and described. Some of these fixtures, such as those of mahogany exhibited at the recent Peoria electrical show, are really beautiful, and the assortment is one that attracts a good deal of attention wherever it is shown.

COOKING DEVICES.—In a twelve-page catalog the Berkeley Electric Cooker Company, Berkeley, Cal., presents an illustrated description of its new electric automatic cooker, for which special advantages are claimed. It differs from the fireless cooker in that heat is supplied regularly to keep the cooking temperature constant. The demand being only 550 watts, the cooker can be connected at any lamp socket.

OIL ENGINES.—Diesel oil engines of the stationary type, rated at from 75 hp to 450 hp, form the subject matter of Bulletin No. 106, published by the Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo. A diagram of the main working parts and a curve showing the principle of operation illustrate the reading matter, which also includes the results of tests made with this prime mover in various industries.

ELECTRICITY IN CONSTRUCTION WORK.—The General Electric Company has issued a bulletin, No. A4080, devoted to the use of "Electricity in Excavation and Construction Work," which deals with both the generating of the energy and its use through motors. It touches on the advantages of electric service and refers briefly to the use of motors in connection with the Panama Canal, the Catskill Aqueduct, the New York Barge Canal and in general building construction.

ELECTRIC DRILLS.—Heavy-duty electric drills for alternating current are illustrated in Bulletin E-22, issued recently by the Chicago Pneumatic Tool Company, Chicago, Ill. Bulletin E-26 refers to Universal electric drills operating on direct or alternating current; heavy-duty electric drills form the subject matter for Bulletin E-27, and Bulletin 34 G is devoted to descriptive and illustrated matter referring to air receivers, after-coolers, air-line drain traps, reheaters and economizers.

STORAGE BATTERY.—A revision of a paper read by Mr. Walter E. Holland at the twenty-sixth annual meeting of the Association of Edison Illuminating Companies, entitled "Characteristics of the Edison Storage Battery," has been issued as Bulletin No. 1011 of the Edison Storage Battery Company, Orange, N. J. Descriptive illustrations of the battery are given, and a number of curves showing the results of various tests and also a reference table of electrical data on the individual-cell basis are included.

BATTERIES.—The Edison Storage Battery Company, Orange, N. J., has recently issued a number of publications of interest to present and prospective users of batteries. "The Edison Storage Battery for Railway Signals" is the title of a twenty-four-page pamphlet which gives a comprehensive illustrated description of its subject matter. In a brochure of thirty-four pages the subject of "Train-Lighting Batteries" is broadly treated, and much information is given. A four-page oblong folder gives instructions for operating the "B" type Edison storage battery for use in automobile and launch lighting, ignition and with private fire and burglar alarm systems, etc. General information and instructions relating to the Edison storage battery for electric vehicles are contained in an eight-page booklet referring to the "A" types.

Business Notes

THE CARL M. GREEN COMPANY has moved its Detroit office from the Penobscot Building to the Free Press Building.

THE SIMPLEX ELECTRICAL COMPANY has changed its name to Simplex Wire & Cable Company. No change of management or interest accompanies this alteration of name.

THE SHELTON ELECTRIC COMPANY, manufacturer of electric vibratory appliances, massage machines and hair dryers, has moved its New York office from 13 West Forty-second Street to 4 East Forty-second Street.

THOMPSON & MACPHERSON.—Messrs. Guion Thompson and R. G. MacPherson, formerly of the engineering department of the American Brass Company, have opened a consulting engineering office at 27 West Main Street, Waterbury, Conn. Mr. Thompson is an electrical engineer and Mr. MacPherson a mechanical engineer.

H. R. WILSON MACHINERY COMPANY.—Mr. Harold R. Wilson, formerly associated with the firm of Arthur S. Partridge, St. Louis, has organized the H. R. Wilson Machinery Company to conduct a general second-hand electric and steam machinery business, with offices in the new Bank of Commerce Building, Broadway and Pine Streets, St. Louis.

MR. R. R. LIVINGSTON, 2 Rector Street, New York, consulting and constructing engineer, who designed among other work the hydroelectric stations of the Auglaize Power Company, near Defiance, Ohio, has opened a Chicago office in the People's Gas Building under the style of "Robert R. Livingston, hydraulic engineer." Mr. A. P. Peck is the resident engineer. The detail engineering work will be handled in the New York office, while all new work and construction for the Middle West will be looked after in the Chicago office.

LACLEDE-CHRISTY CLAY PRODUCTS COMPANY.—At the annual meeting of the Laclede-Christy Clay Products Company the following officers were elected: President, John L. Green; vice-president, treasurer and general manager, Richard D. Hatton; second vice-president, Montague Lyon; secretary, W. J. Westphalen; assistant secretary and assistant treasurer, William T. Christy. Other appointments made at the meeting were: Gas engineer and manager of the chain-grate stoker department, Roger W. Polk; manager general sales department, Henry K. Lackland, and manager of the glass industry department, John H. McKelvey.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL DEVELOPMENT LEAGUE, INC. Secretary, P. S. Dodd, 29 West 39th St., New York.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual convention, Buffalo, N. Y., Feb. 11-13.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th Street, New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting, first Monday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, Western Electric Co New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 27-29, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Chicago, June, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St., West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss. Annual meeting, Natchez, April 21-23.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass. Next biennial meeting, New York, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, H. H. McKinney. Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 21, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,050,780. SYSTEM AND APPARATUS FOR RECORDING ELECTRIC SIGNALS; W. W. Alexander and E. T. Keim, Denver, Col. App. filed April 9, 1911. Electromechanical telegraphing receiving instrument.

1,050,796. PROCESS FOR SEPARATING VANADIUM FROM URANIUM; W. F. Bleecker, Canonsburg. App. filed May 24, 1912. The vanadium is precipitated by electrolytic action.

1,050,797. DISINFECTOR; L. Block, New York, N. Y. App. filed March 13, 1912. Telephone mouthpiece guard.

1,050,812. INDICATOR FOR AUTOMOBILES; D. Dann, Chicago, Ill. App. filed April 27, 1912. A pointer at the rear to indicate turning.

1,050,824. FIRE ALARM; J. E. Goodwin, Cumberland Gap, Tenn. App. filed Feb. 23, 1912. Weight-actuated electrical switch-control mechanisms.

1,050,827. TIMER FOR ELECTRIC WELDING MACHINES; J. A. Heany, Washington, D. C. App. filed May 17, 1912. Automatic electric stopping mechanism.

1,050,830. TROLLEY; E. P. Hinchberger, Pittsburgh, Pa. App. filed May 4, 1912. Yielding extended side plates.

1,050,885. TERMINAL FOR ELECTRIC WIRES; G. R. Welch, Detroit, Mich. App. filed May 3, 1912. Spring wire jaws.

1,050,887. STORAGE BATTERY; J. D. White, Niagara Falls, N. Y. App. filed Dec. 15, 1911. Interlocking flange support for the cover.

1,050,893. TERMINAL FOR BATTERY PLATES; T. A. Willard, Cleveland, Ohio. App. filed April 1, 1909. Rubber-covered binding post.

1,050,908. TROLLEY MECHANISM; L. R. Barker and E. C. Diterich, Riverton, Kan. App. filed Aug. 19, 1912. Short-pole support for cranes, etc.

1,050,912. ELECTRIC RESISTANCE; F. Bölling, Frankfort-on-the-Main, Germany. App. filed June 20, 1912. Sheet-metal clamps for thin sheets.

1,050,939. AUTOMATIC SINGLE-POLE ELECTRIC SWITCH; W. E. Gorton, St. Joseph, Mo. App. filed May 16, 1912. Pneumatically controlled switch for pumping system.

1,050,960. ELECTRICAL RECIPROCATING MECHANISM; J. C. Lincoln, Cleveland, Ohio. App. filed Aug. 12, 1904. Sectional solenoid.

1,050,978. PROCESS OF MANUFACTURING CYANIDE OF HYDROGEN; I. Moscicki and C. Jablczynski, Freiburg, Switzerland. App. filed July 7, 1910. Electrochemical process. (For machine see patents Nos. 930,213 and 933,094.)

1,051,009. TROLLEY HARP; G. W. Rickard and E. C. De Voe, Dayton, Ohio. App. filed March 22, 1912. Cushioned support.

1,051,035. METHOD OF MAKING TRANSPARENT QUARTZ GLASS; A. Voelker, Beuel, Germany. App. filed Feb. 18, 1911. A tube is formed, remelted and drawn and again melted.

1,051,036. ELECTRIC RESISTANCE MELTING FURNACE; A. Voelker, Beuel, Germany. App. filed Feb. 18, 1911. Details of quartz furnace.

1,051,056. LEVITATING APPARATUS FOR CONVEYING AMMUNITION, ETC.; E. Bachelet, Mount Vernon, N. Y. App. filed Feb. 15, 1912. Electromagnetically suspending and moving projectiles.

1,051,060. APPARATUS FOR ELECTROLYZING LIQUIDS; E. Balke, Charlottenburg, Germany. App. filed Sept. 24, 1912. Electrode spacers for making chloride of lime.

1,051,065. ELECTRIC SMELTING; G. H. Benjamin, New York, N. Y. App. filed Nov. 6, 1911. A charge containing iron and nitrogen is submitted to electric current and the action of magnesia.

1,051,091. ELECTRIC-RAILWAY SAFETY DEVICE; E. J. Dunne, Jersey City, N. J. App. filed July 3, 1912. Danger signal is raised when the track is open.

1,051,098. ALTERNATING-CURRENT RHEOSTAT FOR POLYPHASE CIRCUITS; W. H. Gaulke, Milwaukee, Wis. App. filed Jan. 3, 1911. For controlling synchronous induction motor.

1,051,109. TELEPHONE SYSTEM; E. R. Hobbs, Buhl, Idaho. App. filed Nov. 28, 1908. Central-station, common-battery, two-wire, multiple-circuit system.

1,051,113. TELEPHONE; P. L. Jensen and E. S. Pridham, Napa, Cal. App. filed April 22, 1912. Parts of the conductor are subjected to a magnetic field.

1,051,118. TELEGRAPHIC RECORDING INSTRUMENT; E. T. Keim and W. W. Alexander (deceased), Denver, Col. App. filed July 29, 1911. The electrically actuated impression member is movable.

1,051,120. PROCESS OF AND FURNACE FOR SECURING PRODUCTS FORMED IN GASES AT HIGH TEMPERATURES; C. F. R. von Koch, Stockholm, Sweden. App. filed Oct. 25, 1911. The products are cooled by expansion.

1,051,131. APPARATUS FOR THE ENDOTHERMIC REACTION OF GASES; W. S. Lee, Charlotte, N. C. App. filed March 4, 1911. Fixation of nitrogen between two continuously moving surfaces.

1,051,133. FIRE AND BURGLAR ALARM; C. Liaci, New Haven, Conn. App. filed Sept. 11, 1911. Central electric-alarm device mechanically connected to the protected point.

1,051,147. STORAGE-BATTERY PLATE; W. M. McDougall, East Orange, N. J. App. filed July 30, 1910. Protecting and reinforcing frame.

1,051,148. SELECTIVE SIGNALING SYSTEM; J. McFell, Chicago, Ill. App. filed July 6, 1909. Party-line common-battery telephone.

1,051,156. ORGAN TUNER'S KEYBOARD PLAYER; M. J. Olsón, Ishpeming, Mich. App. filed Nov. 12, 1910. For operating keys from a distance.

1,051,182. FEED-WATER PURIFIER; F. E. Ackerman, Pittsburgh, Pa. App. filed May 18, 1911. Boiler-feed water is electrolyzed.

1,051,194. PROCESS OF EFFECTING REDUCTION AND PRODUCING FERROSILICON; E. A. Byrnes, Washington, D. C. App. filed June 26, 1907. Vertical molten resistor column.

1,051,219. PUSH-BUTTON ELECTRIC SWITCH; H. E. Grabau, New York, N. Y. App. filed Feb. 23, 1911. Single button with rocker.

1,051,228. ELAPSED-TIME ELECTRIC SIGNAL; F. C. Hirdler, Oklahoma, Okla. App. filed Oct. 18, 1910. Telephone-call apparatus.

1,051,238. ELECTRICAL REGULATING APPARATUS; C. Lamboeuf, Belfort, France. App. filed Jan. 13, 1911. Starting generator of reversible rolling-mill motors.

1,051,259. DYNAMO-ELECTRIC MACHINE; W. H. Powell and R. B. Williamson, Milwaukee, Wis. App. filed Nov. 21, 1910. Ventilation of rotors.

1,051,261. ELECTRIC-STORAGE-BATTERY PLATE; A. Ricks, Gross Lichterfelde-Ost, Germany. App. filed April 30, 1912. Lead oxide, lead and albuminous substance and a sulphuric acid and phenol hardening agent.

1,051,262. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed Feb. 1, 1910. Requires a trolley wire or rail.

1,051,263. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed Feb. 1, 1910. Automatic signal when the trolley pole is dislocated.

1,051,264. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed July 29, 1910. An alarm in the cab in case of a broken rail.

1,051,270. SELECTIVE SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Feb. 15, 1910. Central telephone station calling system.

1,051,271. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Nov. 25, 1910. Selective telephone signal receiving and sending devices.

1,051,303. PROCESS OF PRODUCING NITROGEN COMPOUNDS; C. E. Acker, New York, N. Y. App. filed March 23, 1909. Producing sodium cyanide by reacting with nitrogen and carbon reagents on an alloy of lead sodium and varium.

1,051,349. ELECTROTHERAPEUTICAL APPARATUS; A. W. Neitro, Seattle, Wash. App. filed July 11, 1910. Electric light bath cabinet.

1,051,373. INDUCTION GENERATOR FOR IGNITION PURPOSES; J. L. Milton, Chicago, Ill. App. filed June 17, 1907. The inductor may be accommodated to a reversible motor.